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# Executive or Experience: Investigating the Role Executive Function Plays in Driving

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# Abstract

**Objective –** Road traffic collisions (RTCs) are one of the leading causes of serious injury and fatality for adolescents and young adults. Human error is responsible for a large proportion of these RTCs in young drivers. Researchers have identified a number of contributory factors in human errors in RTCs. Executive Function (EF) is an area that is limited in research in relation to driving. This study examined the Behaviour Rating Inventory of Executive Function adult version (BRIEF-A) questionnaire, neuropsychological tests of EF as potential predictors of aberrant driving behaviour (i.e. atypical driving) and problematic driving outcomes in a driving simulator.

**Methods –** 71 Young adult drivers (71 in part 1; 22 in part 2) completed (1) an online self-report questionnaire consisting of the BRIEF-A, STAI-6, AQ-10 and the DBQ, (2) four neuropsychological tests of EF, (3) and three simulated drives that assess 11 problematic driving outcomes within a driving simulator (e.g. running red light, failure to signal and RTCs).

**Results –** Higher levels of difficulty in executive skills were predictive of more aberrant driving behaviours. Neuropsychological tests did not find a predictive relationship between problematic driving outcomes however some relationships were found between variables. Other contributory factors were shown to predict small amounts of the variance within aberrant driving behaviours and overall EF score was a better predictor of singular components of EF.

**Conclusion** – In summary findings indicated that the BRIEF-A showed significant association with aberrant behaviour in young adults. Predictive relationships were also found between these measures unlike, neuropsychological tests of EF and problematic driving outcomes in the driving simulator however a smaller sample size was used for the driving simulator section of the study. Future researchers should consider the self-reported examination of EF on individuals who have been charged with motoring offences also, high and low executive skills should be assessed against the reaction of drivers in hazardous driving scenarios. Driving safety officials should consider the affect EF has on driver training and rehabilitation.

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# Executive or Experience: Investigating the Role Executive Function Plays in Driving

While most road traffic collisions (RTCs) are predictable and preventable, more than 1.4 million people die each year globally due to fatal traffic injuries, with more having permanent long-term disability (World Health Organisation [WHO], 2018). RTCs are one of the leading causes of death among individuals aged 10-19 worldwide (WHO, 2016) and among those aged 17-24 in the United Kingdom (Department of Transport for HM Government [DTHMG], 2018a) with young drivers having a disproportionately high crash rate. According to the DTHMG (2018a), 32,810 casualties aged 17-24 were reported to be involved in traffic accidents in 2017, from this 39% were the driver of the car.

Most RTCs have several causes for why they occur, the main ones being human error, environmental problems and mechanical faults. However, it is a well-established notion that human error contributes to a significantly large proportion of these RTCs (e.g. over 75%) (DTHMG, 2018a). In the UK for example, out of all the young drivers (age 17-24) involved in reporting road collisions, 34.3% were due to failing to look properly, 18.8% were driving recklessly, 18.8% failed to judge oncoming traffic speed, and 17.9% lost control of the vehicle (DTHMG, 2018b). Younger drivers in particular are at a higher risk of human error, due to a variety of factors. In 2017, 4% of young drivers (age 17-29) were observed using a hand-held mobile phone while driving (one of the leading causes of distracted driving), compared to 2.2% of older drivers (age 30-59) who were observed doing so (DTHMG, 2019). In 2017, drivers between 16-24 years old had the highest percentage of fatality (28%) whilst driving over the legal alcohol limit (over 81 mg). Finally, young car drivers (age 17-24) have a higher casualty rate (more than three times higher) given distance travelled compared to all other car drivers (DTHMG, 2018b).

Researchers have predominantly focussed on a variety of contributing factors that have been shown to be influential in human error. For example, age, gender (Brown et al., 2017; Morris & Dawson, 2008; Rhodes & Pivik, 2011), risk perception (Rhodes & Pivik, 2011), sensation seeking (Harbeck, Glendon, & Hine, 2017), substance abuse (Choudhary & Velaga, 2019) and anxiety (Shahar, 2009). Executive function (EF) is one area that is considered important when performing complex driving behaviours and difficulty in these skills is suggested to contribute to human error (Hayashi et al., 2018; Mäntylä, Karlsson, & Marklund, 2009; Morris & Dawson, 2008; Starkey & Isler, 2016; Tabibi et al., 2015; Walshe et al., 2017).

This study intends to examine how driving behaviour and their problematic outcomes are affected by an individual's EF abilities. As well as, taking into consideration a number of other contributory factors that affect driving performance (e.g. age, gender, anxiety and autistic traits). Furthermore, this thesis aims to provide further support for the differences in measurement of EF within self-report and neuropsychological testing and lastly, we examine which theoretical conceptualisation of EF is preferable when assessing driving abilities.

## 1.1 Executive Function

### 1.1.1 Definition of Executive Function

EF is regarded to be responsible for adaptive behaviour that is goal-oriented, autonomous, and flexible (Diamond, 2013). It is thought to be involved in the handling of novel situations outside of the domain of 'automatic' behaviour. Norman & Shallice (1986) outlined five types of situations where 'automatic' behaviour would not be enough for ideal performance, therefore EFs are required. These include situations that involve planning and decision making; error correction and troubleshooting; non-rehearsed behaviour; danger or problematic outcomes; and resisting temptation.

EF is often invoked when it is necessary to override a prepotent response (i.e. a response that has been previously associated with a stimulus or has immediate reinforcement available) to a stimulus within the external environment. A classic situation would be when a potentially rewarding stimulus (e.g. a sweet) elicits a prepotent response (e.g. eating the sweet), which conflicts with internally held plans (e.g. told not to eat sweet). Therefore, EF might be engaged in inhibiting the prepotent response to ensure the appropriate response of not eating the sweet is displayed. The suppression of these prepotent responses is normally considered adaptive, however problems for the development of the individual arise when morality is overridden by cultural expectations (Cherkes-Julkowski, 2005). For example, tipping waiting staff at restaurants in Japan is not a cultural norm, thus visiting tourists need to inhibit their own cultural response to prevent confusion or upset.

### 1.1.2 Theories of Executive Function

There is great division in how EF is theoretically conceptualised, as well as substantial disagreement regarding what skills are included in models of EF (Hale & Fiorello, 2004). The struggle formulating a strong and testable theory is represented by a significant meta-analysis that reviewed over 98 tasks used to represent EF (Packwood, Hodgetts, & Tremblay, 2011) In addition to this, more than 68 different terms exist in literature defining components of EF. The most frequently used components are planning, inhibition, working memory (WM), selective and shifting attention, set-shifting or task-switching, monitoring and organisation (Packwood et al., 2011).

The wide conflict on what constitutes EF is also the consequence of difficulty researching the construct. Firstly, EFs are complex skills that are inherently mixed by their nature (Sparrow & Hunter, 2012a). Recruitment of a higher order task always involves basic skills, making it impossible to entirely split EF from its lower-level abilities, such as perception or motor function. The union of these skills result in an impurity of psychological assessment where scores that represent a complex skill also incorporate lower-level abilities. Secondly, there is little agreement in the field on how EF should be measured in research studies. This variability makes comparison research's results and reproduction of findings challenging.

Currently all theories regarding EF have been built off of a neurological, neurochemical, theoretical or empirical basis (Sparrow & Hunter, 2012b). These theories generally share two commonalities: cognitive processes guide other processes or behaviour, and the frontal lobes of the brain are involved in EF (McCloskey, Divner, & Perkins, 2009). However, where the theories differ is in the assembly of EF, which falls into two categories: EF is a unitary construct (Brydges et al., 2012) or EF is a multidimensional model of components (Flanagan & Harrison, 2012a).

#### *1.1.2.1 Unitary Construct*

Most of the first models used to conceptualise EFs were unitary with early attempts focussing on a more singular overarching system guiding all other functions (Brydges et al., 2012). Since then, many of these early theories have been updated to incorporate multiple functions (Baddeley, Hitch, & Allen, 2019). However, unitary theories continue to exist because of the difficulty in distinguishing the various aspects of EF from each other due to high intercorrelations between different subcomponents (Flanagan & Harrison, 2012b).

#### *1.1.2.2 Multidimensional Model*

Although some researchers maintain that EF is an overarching construct, the majority of the field acknowledges that the concept is most appropriately broken down into separate and distinguishable factors within a multidimensional model (Flanagan & Harrison, 2012a). Support for this comes from the result of several trends within literature that show patients with difficulty in executive function are impaired on certain executive skills rather than all of them, which contradicts what the unitary side proposes (Wu et al., 2011). Also, there are age differences between when certain EF develops within childhood, adolescence and adulthood that also provides evidence for a multi-dimensional model of EF (Anderson et al., 2010).

### 1.1.3 Development of Executive Function

Trends within developmental literature have shown that the most important areas of growth in EF are through infancy, middle childhood and adolescence. However, late adolescence and early adulthood are becoming increasingly important, as this age range encompasses key entitlements within individuals such as, eligibility to drink alcohol, drive a motorised vehicle and be employed. During this developmental period, the brain continues to mature through structural enhancement and increased myelination of areas in the frontal lobe (e.g. prefrontal cortex). This has been reflected in EF ability as components such as, working memory, task-switching and problem solving are at their highest levels (Anderson et al., 2010). However, there is data to suggest that within this age range, participants aged 18 compared to 17 and 19 year olds differ in their EF abilities, with 18 year olds performing worse in neuropsychological tests of EF (Taylor et al., 2013b). One proposed theory for why this occurs, is that individuals around this age go through a period of protracted neural reorganisation and synaptic pruning that causes a temporary decrease in executive abilities (Blakemore & Choudhury, 2006). Once this reorganisation is complete, EF abilities are returned to normal levels, which explains the difficulty in executive skills within this age range (Taylor et al., 2013b).

### 1.1.4 Measures of Executive Function

#### *1.1.4.1 Neuropsychological Measures of Executive Function*

Neuropsychological tests have been used to assess EF from the beginning of research into the area, these tests generally assess EF through clinical impairment (Faria, Alves, & Charchat-Fichman, 2015). This standard of neuropsychological testing has been deemed as such because of their sensitivity to frontal lobe damage, rather than being operationalised to assess the theoretical concepts of EF and the cognitive processes they entail (Bryan & Luszcz, 2000a).

Due to the multifaceted nature of EF, there is an inordinate number of tasks that are considered to assess EF. However, some tasks have been shown to be more effective within the field than others. One such measure is the Stroop Interference Test, which has been used predominantly to provide a measure of cognitive inhibition (i.e. the ability to inhibit an overlearned response in favour of an unusual one) within EF literature (Bryan & Luszcz, 2000b). Another famous measure is the Digit Span Task, which takes theoretical understanding from Baddeley's Working Memory model (RepovŠ & Baddeley, 2006). It is used to assess working memory capacity and updating respectively, within the executive system for the processing of new information. Furthermore, the Trail Making Task is a notable assessment tool for measuring difficulty in task-switching as individuals display poorer completion times when having to switch between two types of stored information (e.g. alphabet and numbers) to complete the task (RepovŠ & Baddeley, 2006). Lastly, cancellation tests are used to assess executive and attentional functions through visual search tasks that highlight an individual's proficiency in short-term memory, processing speed and search organisation, which is often considered to reflect EF (Benjamins et al., 2018).

#### *1.1.4.2 Questionnaires of Executive Function*

Questionnaires are considered an effective tool in measuring difficulty in executive skills within a population. Existing questionnaire items within literature emphasise the use of naturalistic situations within everyday life that demonstrate executive functions and form clinical scales that categorise items into various areas of EF. Examples of this are found in the most popular self-report scales used within literature such as the Executive Function Index (Spinella, 2005); Learning, Executive and Attention Functioning Scale (Castellanos, Kronenberger, & Pisoni, 2018); and the Behaviour Rating Inventory of Executive Function (G. A. Gioia, Isquith, Guy, Kenworthy, & Baron, 2001).

##### *1.1.4.2.1 The Behaviour Rating Inventory of Executive Function*

The Behaviour Rating Inventory of Executive Function (BRIEF; Gioia et al., 2001) is a questionnaire designed to assess emotional, behavioural and metacognitive skills that are broadly described as executive abilities in the form of either a self or informant report. Developed by Gioia et al. (2001), the measure has gained significant popularity in several clinical settings and is considered the current standard for the assessment of executive skills within range of age groups (Balsamo et al., 2019; Egan, Cohen, & Limbers, 2019). The inventory consists of various overlapping clinical scales including inhibition, shift, emotional control, monitoring, initiation, working memory, plan/organise, and organisation of materials.

The inhibition scale is defined as the ability to suppress an inappropriate or intrusive prepotent response (i.e. a response that has been previously associated with a stimulus or has immediate reinforcement available) while enacting a less automatic response (Miyake et al., 2000). Individuals with difficulties in inhibition cannot disregard an underlying tendency (e.g. focusing on a negative outcome when driving) despite conscious attempts to focus on alternative thought.

Shift (i.e. task-switching or set-shifting) is a scale that assesses difficulty in the ability to change or shift from one ‘unrelated’ situation, activity or aspect of a problem to another, as the circumstance demands (Brady et al., 2013). The phrase ‘unrelated’ is a crucial part of its definition as multi-tasking is similar, although the ultimate goal of the task is ‘related’ in some way. This determines how quickly the skill is to master as a result, a good example of shift is driving, as drivers will utilise task-switching abilities by switching back and forth from driving to conversing with passengers. In contrast, driving also involves multiple actions that ultimately meet the same goal in order to drive successfully, which is an example of multi-tasking.

Emotional control is a scale that addresses the manifestation of EF in the emotional realm and measures an individual’s ability to modulate emotional responses. Inability to control this is expressed as emotional explosiveness. An example of this behaviour is observed in individual's who cry or laugh at unexpected situations consistently with little provocation.

Self-monitoring encompasses the extent an individual can keep track of their own behaviour and the effect it has on others. Problems with self-monitoring are described as an unawareness of one's own behaviour and a disregard for an incident that has occurred. Task monitoring is an area that focuses more on how an individual assesses and monitors performance in completing a task. An example of this, would manifest as a failure to recognise one's own errors when completing a task.

Initiate is a component that deals with independently initiating responses, ideas, or problem-solving stratagems. Poor initiating ability can typically reflect as non-compliance or disinterest in novel tasks. However, individuals with these problems commonly want to succeed in these tasks but are unable to get started with them and will require extensive prompts or cues in order to begin a task or activity.

Working memory is considered one of the most critical components of EF as it handles actively maintaining information in the mind for the purpose of completing a task or providing a response. It is essential for a variety of cognitive activities including executing multiple step instructions or a sequence of actions (e.g. operation of a motor vehicle). Individuals with deficits in their working memory ability will have trouble remembering things (e.g. directions), lose track of work or forget a task they were asked to complete.

The plan/organise scale is focussed on two aspects of EF, the planning side is the ability to anticipate future events and develop the appropriate measures ahead of time to successfully carry out a task or activity. The organisation side deals with the mental aspect of organisation bringing direction to information, actions, or materials to achieve a goal. Combined the plan/organise scale seeks to measure the completion of an activity in a timely manner or alternatively, it is seen as the ability to obtain all the tools and materials necessary to complete an activity in advance. Poor plan/organise ability is demonstrated by approaching tasks in a haphazard manner and easily becoming overwhelmed, which results in taking longer than needed on a task or not having the correct tools and materials to complete the task effectively.

Organisation of materials focuses on the physical aspect of organisation such as arranging the workplace, living spaces and material belongings in an orderly way. Being disorganised in this way materialises itself as forgetfulness. An example would be to lose track of direction or belongings, consequently hindering progress in the current task. For the purposes of this thesis, The BRIEF-A (Adult version for ages 18+) will be chosen alongside the Stroop Interference Test, Digit Span Task, Trail Making Task, and a double letter cancellation task to assess EF. This is due to literature suggesting that self-report questionnaires measure different aspects of EF compared to neuropsychological tests and it stresses that experimentation with both types of measure is preferable (Buchanan, 2016).

## 1.2 Executive Functioning and Driving

### 1.2.1 How Does Executive Function Relate to Driving?

Given that EF and driving utilise similar areas of adaptive thought, it is expected that these two areas overlap in some way. Using the clinical scales of the BRIEF as an example, inhibition would be used in driving to stop drivers from making any impulsive decisions such as running red lights, speeding, racing for a gap when merging and overtaking other road users in risky situations. This improves the chances of avoiding an accident and can potentially save the driver's life as well as other road users lives (ROSPA, 2017). Furthermore, distracted driving literature is consistent with this understanding, as individuals who frequently texted while driving showed higher levels of impulsivity and lower levels of EF (Hayashi et al., 2017). By engaging in a distracting behaviour like texting while driving, individuals are increasing the likelihood of being involved in an accident (Klauer et al., 2014). In addition to this, Pope et al. (2016) found that inhibition was the most significant predictor of getting a ticket (for violating traffic laws) and that for every increment in inhibition score there was a 14% increase in the odds. This shows that inhibition is an important aspect of EF in driving, as the suppression of inappropriate driving behaviour can make drivers safer on the roads depending on their aptitude.

Shift is another area thought to impact driving as it is a complex skill that requires the ability to switch from one task to another without compromising performance as much as possible. However, the problem with driving is that it involves tasks that are related to the overall goal of driving. For example, changing gears, steering, checking mirrors, blind spots, looking far ahead to prepare for approaching traffic, which all need to be completed regularly and in a short space of time. While other tasks in driving are unrelated to the overall goal of driving (e.g. conversation, changing the radio station, manipulating the air conditioning or satnav). By adding to this list of growing priorities, driving performance can be hindered on occasion causing individuals to be unsafe on the road. Functional Magnetic Resonance Imaging (fMRI) research has investigated this phenomenon and has revealed that specific regions of the brain (e.g. medial prefrontal cortex and left superior occipital gyrus) that are utilised in driving are suppressed when given an additional auditory task to complete. This resulted in the deterioration of driving performance on a car-following task where participants had to modify their speed in relation to the lead car whilst completing an auditory task (Uchiyama et al., 2012). Furthermore, parietal lobe activation that is associated with spatial processing was found to decrease by 37%

when participants listened to auditory sentences when completing a driving task (Uchiyama et al., 2012). This suggests that the decline of brain activity in regions of driving behaviour is induced by a secondary auditory task that overloads shifting capacity. This supports the view that Shift is essential in driving, as research has shown that individuals dedicate less time in responding to changing events when drivers are introduced to a secondary unrelated task.

Emotional Control (i.e. emotion regulation) is considered central in driving as it deals with the control of emotional content and its subsequent reaction, which can make drivers more or less dangerous on the road. In emotionally salient driving situations, individuals can become overly involved in what has occurred and as a result distract themselves from their current driving situation, potentially causing a collision. Research by Hancock et al. (2012) demonstrated this by using a dual-task simulated driving paradigm alongside the visual presentation of emotionally salient stimuli. They found that unpleasant images produced the greatest overall amount of lane excursions (i.e. not keeping within their lane) as well as prompting higher mean speeds compared to pleasant and neutral images. This shows that concurrent processing of emotional stimuli when driving can cause a detriment to a person's driving ability. It is reasonable to assume this, as it is well documented that unpleasant imagery or actions observed take higher priority in visual attention than other tasks (Bradley et al., 2000; Bradley et al., 2003; Buodo et al., 2002; Calvo & Lang, 2004). This demonstrates that an individual's ability to successfully control the effect emotional content has on themselves mediates how distracted a driver can become, which supports the view that emotional control is invaluable when driving.

Following on from this, self-monitoring is noteworthy as it allows for consideration of one's behaviour and the impact, they have on other road users. Furthermore, it provides the driver the benefit of hindsight in the errors and violations they have made on the road allowing for the correction of these mistakes in the future. To our knowledge, there is no empirical research to provide evidence for the influence of this component on driving behaviour and its outcomes apart from anecdotal.

Another component that is thought to influence the result of driving is Task Monitoring, this is crucial for staying focussed on the task of driving. This is different from the component of self-monitoring as it deals with the success and failures of tasks like driving on more proactive basis whilst the task is ongoing. Research by Pope et al. (2016) found that task monitoring is positively correlated with being pulled over by law enforcement and for every increment in task monitoring score, the chances of being pulled over increased by 9%. This suggests that poor monitoring of driving has led to behaviour that necessitates being pulled over by law enforcement. However, this can be interpreted in a multitude of ways as being pulled over can be for something minor (e.g. headlight broken) to breaking road traffic laws (e.g. speeding). Despite this, Task monitoring does show to affect an individual's driving behaviour on the road.

When exploring literature on EF and driving, the Initiate component does not resemble any example of driving behaviour, which may be why previous literature has not found any associations between this component and driving. Research by Rike et al. (2015) has confirmed this, by investigating initiating behaviour and driving self-efficacy within brain injury patients. Additionally, Pope et al. (2016) also recorded data on the initiate component when investigating problematic adolescent driving and decided to exclude the variable from final analysis due to insubstantial data. This does suggest that initiate does not actively play a part within driving. Although, it is reasonable to consider that it is possible this EF component is pivotal in the decision to drive rather than being actively involved.

Working memory (WM) is a commonly studied area of EF that can be considered vital as it collects and maintains information about the roads, signs, markings, weather conditions etc. to inform other functions on the correct action to take. Research by Ross et al. (2014) validates this as they found that increased verbal WM load reduces performance on a lane change task. They also found differences in performance between individuals with high (e.g. better performance) and low (e.g. worse performance) WM capacities. Furthermore, they showed that individuals with higher WM capacity are less negatively affected by the increase in verbal WM load on the lane change task. Similarly, research investigating WM, visual attention and hazard perception that found that low WM capacity participants performed poorer on hazard perception tasks and reported more instances of inattention (Wood et al., 2016). Moreover, recent research observed driving was impaired when engaging in a semi-naturalistic grocery list recall task that showed a similar effect to the preceding studies (Louie & Mouloua, 2019). This demonstrates that WM is an important component of EF involved with driving, as overloading WM capacity creates a detrimental effect to driving performance in a number of key areas (e.g. lane changing, hazard perception and predicting distracting behaviour).

Plan/Organise is considered essential in driving as it is used in the prediction and planning of future events (e.g. predict if car is going to swerve and plan how to respond) as well as the organisation of the appropriate actions to take when driving (e.g. slow down to assess situation, swerve to avoid). The proficiency of this component controls a driver's ability to react fast and effectively to these types of driving situations. To provide substance to this claim, Snellgrove (2005) developed an instrument named the Maze Task to assess planning and organisational abilities against on-road driving performance in elderly dementia patients (e.g. left and right turn faults, overall result as a percentage, number of laws broke and interventions). On-road driving performance was categorised as either pass or fail, and completion time as well as amount of errors were recorded for Maze Task performance. A Logistical regression discovered that completion time and amount of errors were directly related to on-road driving performance. Furthermore, patients who performed worse on the Maze task were more likely to fail in the driving test and the opposite was true for individuals who performed well on the Maze Task. However, this study was conducted on elderly drivers and the interaction shown in analysis may be less prominent in younger populations as there is a lower level of general cognitive decline and prevalence of dementia in this age range (Prince et al., 2014). Following on from this, Pope et al. (2016) investigated the planning and organisational abilities of a young adolescent population and found that Plan/Organise score on the BRIEF-A was significantly associated with motor vehicle collisions. Further, for every 1.5 standard deviation in Plan/Organise score there was a 10% increase in the odds of having a collision. Also, Plan/Organise score was a significant predictor of being pulled over by law enforcement. According to this research, the Plan/Organise component increases or decreases the chances of being involved in a road traffic collision. Despite this, Plan/Organise is a weighty component of EF involved in driving, as an individual's planning and organisational abilities can influence on-road driving performance.

Organisation of Materials has little to no research in relation to driving practice however, difficulty in this component is thought to cause individuals to forget directions (e.g. take wrong turning), proper road traffic procedure (e.g. forgetting to signal when turning) and other information that is critical to safe driving practice on the road. Compelling evidence from Pope et al. (2016) suggests that problems with the Organisation of Materials component can cause drivers to engage in dangerous behaviour that warrants intervention. Furthermore, Organisation of Materials was found to be associated with greater odds of being pulled over by law enforcement. This suggests that Organisation of Materials is an influential component in driving however, requires more investigation as current literature does not substantiate this claim enough.

From exploring the clinical scales of the BRIEF-A, it has become evident that EF components are used in many key areas of driving and they should be researched further separately.

### 1.2.2 Methods of Investigation into Driving Performance

Researchers have approached investigation into driving performance in approximately four distinct ways: telematics (e.g. black box recorder), driving simulators, observational assessment and self-report questionnaires. Telematics records data such as, GPS coordinates, steering input, speed, braking and other measurements that can indicate individual driving style (e.g. aggressive acceleration and heavy braking). Simulators have shown the most flexibility in research by replicating environments and situations that can target specific incidents consistently, which is good for investigating behaviour such as, texting and driving (Hayashi et al., 2017). However, there is debate about how applicable simulators are compared to on road driving observations as not all scenarios a driver encounters on the road are replicable in a virtual environment. On road driving assessment is considered to be the most naturalistic way of collecting figures on drivers however, an experimenter's presence can encourage participants to act a certain way (e.g. law abiding) when they would not. Self-report questionnaires very useful at recording incidents and opinions of specific driving behaviour and scenarios and can be distributed to a much larger audience than any of the other measures without the major financial expense.

Following on from this, there are a range of self-report measures that researchers can choose between to investigate driving behaviour such as, the Multidimensional Driving Style Inventory (Taubman et al., 2004) and the Dula Dangerous Driving Index (Dula & Ballard, 2003). However, and the Driver Behaviour Questionnaire (DBQ; Reason et al., 1990) is the most prominent self-report measure used within driving literature. The DBQ examines an individual's perception of their own aberrant driving behaviour (i.e. away from safe driving practice) and has been shown to have a predictive relationship with road traffic collisions retrospectively (de Winter & Dodou, 2010). Furthermore, the DBQ has been validated cross-culturally with minimal adaptation to the original items (Lajunen, Parker, & Summala, 2004), to our knowledge, it is the only self-report measure to consistently be used in conjunction with EF measures. This suggests that the DBQ is a reliable measure to include in research that involves investigating EFs and driving behaviour within a general population.

### 1.2.3 What is the Current State of Literature?

#### *1.2.3.1 The Link Between Age, Executive Function and Driving Ability*

Given that young drivers are at risk of dangerous accidents on the road and EFs have been evidenced to be involved in dangerous driving behaviour, it is important to consider the role of age within EF and driving.

##### *1.2.3.1.1 Young Drivers*

There is a large proportion of EF and driving research that centres around individuals between the ages of 17-24, this may be because of the increased injury and fatality rates within this population. Driving simulator research has found various areas of EF that are related to driving performance (Walshe et al., 2017). In particular, inhibition, working memory (WM) and updating seem to be the main findings using these methods. Mäntylä et al. (2009), investigated the effects of six neuropsychological tests of EF that assessed inhibition, updating and task switching on a Lane Change Task (LCT). They found that individual differences within EF tests were related to simulated driving performance

(Mäntylä et al., 2009). In addition to this, the updating EF component was shown to be the primary predictor of driving performance (Mäntylä et al., 2009). Interestingly, they discovered that previous experience of computer games compensated for inefficient WM functions.

Following on from this, Guinosso et al. (2016), conducted a study where participants completed three EF tasks (e.g. Stroop Task, Wisconsin Card Sort Task and an Attention Network Task) before doing two driving challenges. The first was a baseline drive where the participant drove in a variety of driving environments: residential, highway, commercial, school, and a rural zone. The second involved the same driving challenge but they were required to complete a verbal task to increase cognitive demand on WM. They found that inhibition & alerting was associated with better driving performance at the first and second drives.

More recently, Louie & Mouloua (2019) explored the role of WM within a semi-naturalistic driving task. They first assessed individual's WM capacity through various span tasks (e.g. operation, rotation, symmetry and reading span) and then studied participant's performance on a Grocery List Task (GLT). This involves remembering a list of ingredients while completing a series of "real life" mathematical operations (Louie & Mouloua, 2017). What they found was that drivers who were engaged in distracted driving from the GLT showed slower braking capacity and response times compared to driving without the GLT. Additionally, WM capacity partially mediated the effects of distraction on braking response time. They also noted that there was a general trend towards WM capacity as a moderator of distraction in driving performance. Similarly, research by Ross et al (2014) contributes to this idea that WM capacity has a mediating effect on driving tasks. They assessed participants using a series of WM tasks (e.g. N-back Task) and afterwards examined their performance on a Lane Change Task (LCT). They found that performance on the N-Back task & LCT deteriorated with increased verbal WM load and higher WM capacity was related to better LCT performance. Also, lane change initiation & percentage of correct lane changes for high WM participants were influenced less by verbal WM load.

As well as simulator studies, researchers have also investigated EF and driving through questionnaire methods. Hayashi et al. (2018), conducted a survey with 136 undergraduate students (18-24 years old), the questionnaire included driving related items from Schlehofer et al. (2010) and all items from the Executive Function Index (EFI; Spinella, 2005). They found that better EF skills assessed by the EFI was associated with a lower likelihood of four types of dangerous driving behaviour and negative driving outcomes. Another earlier study by Hayashi et al. (2017), investigating EF influence in texting while driving within another university sample. A survey was given out to students that included two sets of questions adapted by Atchley et al (2011) that measured frequency and perceived danger of reading, replying and texting whilst driving. From scores on these questions they were put into one of two groups: Texting while driving (TWD) and a non-TWD group. In addition to these questions the survey also had the EFI and two inhibition measures: Barratt Impulsiveness Scale and the Monetary Choice Questionnaire included. Analysis showed that students who frequently texted when driving had lower levels of EF and higher levels of impulsivity compared to controls. Particularly, strategic planning, impulse control and total EFI score were significantly different between groups also, EFI total significantly correlated with TWD frequency and danger. In summary, all the studies mentioned in this section suggest that EF is connected with the distracted driving behaviour of young adults.

##### *1.2.3.1.2 Middle-Aged Drivers*

Only one study to date has claimed to investigate middle-aged individuals in relation to EF abilities within driving. This study by León-Domínguez et al. (2017) took 270 drivers (aged 18-71) and divided them into three groups: Control group, ‘partial point loss’ group and ‘total point loss’ group. In Spain, when you are awarded a driving license you start off with 12 points or 8 for a provisional and if you lose all your points on your license you are given a 12-month ban (Jefatura de Tráfico, 2019). These drivers were then given a computerised version of the Seville Neuropsychological Test Battery to complete that assesses the functional integrity of EFs and was carried out in state-approved official driver education classes. What they found was that drivers with partial or total point loss performed worse than controls on neuropsychological tests. Contrary to this, drivers with total or partial point loss had significantly faster reaction times on attentional tasks than the control group. The researchers suggest that quicker reaction times are potential markers for unsafe driving as quicker reactions are required as well as less thought is put into decision making. Additionally, the interaction between age and EF tests were analysed, demonstrating significant positive correlations mostly in reaction time within the test battery. These results provide good evidence for the decline in EF throughout an individual’s lifespan and for the role EF plays within driving in this age range. However, it can be criticised for not pursuing middle age further in the methodology of this study, as participants could have been split into young, middle age and elderly age groups to be analysed with measures of difference. Nevertheless, it is the only study of its kind to our knowledge, which includes middle aged individuals within the experimental procedure and states that EF performance declines throughout a person’s life.

##### *1.2.3.1.3 Elderly Drivers*

Driving in the elderly has generally been researched in the overall understanding that cognitive functions and mobility are in a general decline within this group. This has led researchers to focus more on the overall effect of aging on driving rather than specific areas of cognitive decline such as EF, which is thought to affect driving ability more than general aging. As a result, research that exclusively examines the role EF plays within driving is scarce, nevertheless there are studies that investigate this relationship. Adrian et al. (2011), conducted a study involving elderly drivers completing ten neuropsychological tasks, each theorised to involve different areas of EF (e.g. TMT, Stroop Task). As well as this, participants were asked to take part in a test ride for investigating practical fitness to drive (TRIP). This consists of an on-road assessment on a pre-determined route where the examiner observes the participant's actions when driving and scores them based on a behavioural checklist. The study found that when controlling for gender and age, TRIP score was significantly correlated with four of the neuropsychological tests. Additionally, when gender, age and extraversion were added to these tests in a multiple regression analysis, the model accounted for 44% of the variance in TRIP score. This demonstrates that a decline in driving ability is due to a number of variables including age, gender, extraversion and EF decline.

Another study involving the elderly, driving and EF comes from Daigneault, Joly, & Frigon (2003), they recruited elderly drivers (aged 65+) and split them into two groups based on their accident records for the last 5 years (e.g. With accidents and Without accidents). The groups completed a self-report questionnaire on risky behaviour (ACR) and participated in four neuropsychological tests: Colour Trial Test (CTT), Stroop Colour Word Test (SCWT), Tower of London (TL) and the Wisconsin Card Sorting Test (WCST). They found that the accident group has poorer performance overall on the neuropsychological tests compared to the control group. Specifically, the accident group took significantly more time on all conditions of the SCWT as well as this, planning and execution times on the TL were also significantly longer compared to controls. In addition to this, significant differences were observed in the ACR on the intentions and subjective norm scale between groups. This shows that there is a clear difference between elderly drivers who have been involved in accidents and those who have not in terms of their EF abilities, which caused them to show more risk-taking behaviour when driving.

##### *1.2.3.1.4 Investigation Between Age Groups*

Research within driving and EF has not always involved investigating a specific age but rather multiple age groups. Driving simulation studies have focused on the differences presented between younger (e.g. 17-24) and older drivers (e.g. 25+). A recent study by Ledger et al. (2019), investigated driving ability and EF skills within two age groups: young (aged 17-23) and old (aged 63-85). The simulated driving task outputted three variables: overall driving score, speeding and lane deviation. To assess various areas of EF, they used a Trail Making Task (TMT) and three components from the Rey Complex Figure Test: CFTcopy (tests copying ability), CFTorg (tests organisational ability) and CFTrecall (tests recall ability). From their testing, they discovered CFTcopy was the most significant predictor of speeding in the simulator as well as CFTorg being a significant predictor in lane deviation. Overall, they found that EF skills are influential in driving performance irrespective of age group and that both these populations suffered in their driving if they had more difficulty on the EF tests.

Another simulation study investigating differences between ages comes from Brown et al. (2016), who similarly tested a population of young adolescents to adults (19-39 years old). They assessed EF using three tasks: Connor's Continuous Performance Test, the Iowa Gambling Task and the Stoplight Task. Driving performance outputted three more complex variables using mean speed, time before committing a risky manoeuvre and accelerator position in a merging scenario. They found that drivers who exhibited riskier behaviour were driving at faster speeds on the virtual highway. They also discovered that risky behaviour resulted in higher compression of the acceleration pedal when merging and more disinhibition when driving compared to the control group. In addition to this, riskier drivers were shown to have slower reaction times, more errors and more risk-taking behaviour on EF tasks compared to controls. This suggests that individuals who show poor performance on these EF tasks are more likely to exhibit risky driving behaviour.

Questionnaire studies have also been used to investigated differences between ages for example, Pope et al. (2017), who sought to investigate the role EF plays in distracted driving between young, middle-aged and elderly individuals. Participants were asked to complete a Distracted Driving Behaviours Questionnaire, which includes items about demographics and driving behaviour on a weekly basis (adapted from Welburn et al., 2010). EF was measured through the inclusion of the BRIEF-A within data collection. What they found was that EF difficulty, alongside age and gender were linked with frequency to engage in distracted driving behaviours. In addition to this, EF difficulty was found to be a significant predictor in distracted driving behaviour even when controlling for age and gender. This suggests that EF is associated with driving behaviour despite controlling for prominent influencers of driving behaviour.

Following on from this, research from Tabibi et al. (2015) assessed individuals aged 19 to 49 years old using the Driver Behaviour Questionnaire (DBQ; Reason et al., 1990) and three EF tasks: Continuous Performance Task (CPT), Backward Digit Span Task and a Go/No-go Task. The results of the study indicated that aberrant driving behaviour (i.e. deviating from the normal driving practice) and driving errors are related to sustained attention and behavioural inhibition. In particular, inhibitory control was shown to predict driving violations & errors suggesting that inhibition is a key influencing component of EF within these aberrant driving behaviours.

More naturalistic studies have also taken place between ages within this area, such as Adrian et al. (2019) who conducted multiple on-road driving assessment evaluations using the test ride for investigating practical fitness to drive (TRIP) method. They assessed individuals EF ability through nine neuropsychological tests considered to assess three components of EF: inhibition, shifting and updating. Results showed that on-road driving performance was related to inhibition precisely, individual differences that were observed in TRIP score were mediated by inhibition. In addition to this, inhibition declined with age especially within elderly drivers that made them less efficient drivers. This suggests that inhibition is an executive skill that is important in driving and declines with age.

#### *1.2.3.2 The Link Between Gender, Executive Function and Driving Ability*

Studies measuring gender have mostly used the variable as a control method to gain more clarity in analysis. However, some studies been shown to directly assess the effects of gender on dangerous driving in conjunction with age and other demographic variables. One such study comes from Tabibi et al. (2015), who used the DBQ to assess aberrant driving behaviour in a university population (aged 19-49), discovered that gender alone accounted for 42% of variance in overall DBQ score and 64% in the driving violation subscale. Another example comes from Adrian et al. (2011), who measured on-road driving performance (TRIP) in elderly drivers, found that gender, age and extraversion accounted for 44% of the variance in their driving ability. Pope et al. (2017) also discovered similar findings to this within their survey study using their driving behaviour questionnaire and the BRIEF. However, they had a better suited distribution of ages within their study (e.g. young, middle aged & old) compared to Adrian et al's study. Nevertheless, they found that age and gender accounted for 43% of the variance in driving behaviour score. In addition to this, overall BRIEF score (i.e. global executive composite) within the regression analysis increased the model's variance to 53%. This demonstrates that gender as well as other demographic variables account for a large degree in the variability in driving behaviour and performance that needs to be accounted for in experimentation.

#### *1.2.3.3 The Link Between Anxiety, Executive Function and Driving Ability*

Research examining the link between anxiety, EF and driving is a relatively underappreciated area and only small amount of studies have attempted to explore any part of this interaction. Firstly, recent literature investigating how anxiety affects EF ability comes from Gustavson et al. (2019), they collected data from 192 undergraduate students with several self-report anxiety questionnaires and nine neuropsychologically-based EF tasks that were then put into three categories: Inhibition, Updating and Shifting. They found that only one of the anxiety measures (STAI; Spielberger et al., 2015) negatively correlated with two EF tasks. This shows that anxiety can influence the results of some EF tasks and should be considered during research into the topic.

Secondly, Shahar (2009) has found interesting results that suggest anxiety is a contributory factor within aberrant driving behaviour (i.e. deviating from the normal driving practice). Shahar (2009) investigated this through a survey of 120 employees of hi-tech companies, which included questions from the STAI and DBQ. The results reported that STAI scores (e.g. trait anxiety) and license seniority (i.e. how long you have had your license) accounted for 19% of the variance in DBQ (e.g. aberrant driving behaviour) scores. In addition to this, trait anxiety and license seniority also accounted for 12% of the variance in lapses, 18% in errors, 9%, in ordinary violations and 7% in aggressive violations. Furthermore, Shahar (2009) split participants into three groups: high trait anxiety (HTA), middle trait anxiety (MTA) and low trait anxiety (LTA) in order to conduct an ANOVA. This resulted in significant differences between all three groups however, the most prominent interaction was between LTA and HTA groups. This research demonstrates that anxiety has an influencing effect on aberrant driving behaviour.

Lastly, to our knowledge only one study has sought to examine how anxiety, EF and driving affect one another in a meaningful way. This study by Wong, Mahar & Titchener (2015) recruited 75 Australian university students to complete the STAI and DBQ alongside a parametric go/no-go task (set-shifting or inhibition) and an n-back task (updating). They discovered that a significant positive relationship existed between STAI scores and DBQ lapses subscale as well as this STAI scores were found to be a significant predictor of updating in the n-back task. This suggests that anxiety has an association between both EF and driving that could potentially mediate this interaction.

#### *1.2.3.4 The Link Between Attention, Executive Function and Driving Ability*

Most literature has focused primarily on the how attention directly links with driving ability, as it is a crucial component in how be safe and competent on the road. As a result, several attention-based fitness to drive tests have been developed to provide an indication of a person's driving ability based on their attentional skills such as, the Useful Field of View Test (UFOV; McManus et al., 2015), the motor-free visual perception test (Mazer, Korner-Bitensky, & Sofer, 1998), cancellation tests (Benjamins et al., 2018) and the Attention Network Task (ANT; Weaver et al., 2009). Some of these tests were designed to also assess selective attention (i.e. executive control or attentional control) that is thought to access executive processes such as, inhibition and problem-solving skills (Weaver et al., 2009). This makes these tests useful for research investigating attention-based executive skills within driving.

Studies using the Attention Networks Test for Interactions and Vigilance (ANTI-V; Roca et al., 2013) have been inconclusive when assessing attention-based executive skills in driving. For example, Weaver et al. (2009) used the ANTI-V and the Manitoba Road Test in both driving simulations and on-road testing. The Manitoba is a demerit-based scoring system which assesses driving performance by the amount of infractions a participant makes such as, speeding and signal violations (Weaver et al., 2009). In this study, two overall ANTI-V measures were found to have a good level of prediction for overall driving performance in the driving simulator. However, no association was found between the executive network assessed by the ANTI-V and driving performance in the both the simulator and the on-road test. Weaver et al. (2009) stated that these results were unexpected, since the attention-based executive network was considered to play a key role within driving. They concluded that potential associations could be found by examining specific driving scenarios and using an alternative driving performance measure.

Following on from this, Roca et al. (2013) built upon these recommendations within their research that utilised three categories of hazards for specific traffic scenarios: Behavioural Prediction (i.e. anticipatable behaviour from a visible precursor before it emerges into a hazard), Environmental Prediction (i.e. anticipatable behaviour from a non-visible environmental precursor before a hazard appears) and Dividing and Focusing Attention (e.g. Multiple precursors for potential hazards are available when a hazard emerges). These categories were suggested to produce different results depending on the attentional network assessed on the ANTI-V and the driving performance measures considered. However, their findings were ambiguous, as attention-based executive skills were found to be linked only with overall crash frequency rather than a specific driving category. This suggests that attention-based executive skills are utilised in driving but are difficult to evaluate independently from other attentional networks.

On top of this, similar results have also been found using the UFOV test when investigating attention and driving. For example, a study aimed at predicting road traffic collisions with the UFOV test found that scores on the selective attention component were predictive of collision involvement (McManus et al., 2015). Further results also found that selective attention was partially mediating the effect of driving experience on the frequency of collisions. This once more indicates that a link is present between attention-based executive skills and driving. From the studies discussed, it is clear that a relationship exists between attention-based executive skills and driving. What is unclear, is what specific driving situations are these skills utilised and can they be operationalised?

#### *1.2.3.5 The Link Between Autism Spectrum Disorder, Executive Function and Driving Ability*

##### *1.2.3.5.3 Autism Spectrum Disorder*

Autism Spectrum Disorder (ASD) is a well-known neurodevelopmental disorder where a majority of individuals are said to have some form of executive difficulties (Hughes, Russell, & Robbins, 1994). As individuals with this disorder are placed on a spectrum, differences in EF ability are not uncommon based on the severity of the disorder. Literature has shown that the natural development of EF occurs at a reduced rate within autistic individuals and that this may interfere with the learning process or skills required to drive effectively on the road (Hughes et al., 1994). Cox et al. (2016) conducted a study investigating the differences between ASD and control participants on basic & tactical driving tests with three adapted EF driving tasks: dual task processing, response inhibition and working memory. They found that ASD drivers had significantly slower reaction times when steering and impaired working memory abilities resulting in a decrement to driving performance. However, ASD individuals showed no difference compared to controls in the dual task condition. Interestingly, young ASD adults demonstrated poorer overall performance than their typical novice counterparts despite being older.

A follow up study by one of the co-authors of the original paper has also found fascinating findings (Cox et al., 2017b). They performed a similar methodology as the original with the addition of three training conditions (on-road training, experimenter feedback training and automated feedback training) and a pre-post session to measure for any improvement in driving ability. They found that ASD drivers performed worse than a normative sample in terms of overall tactical driving and EF scores. One noteworthy finding is that higher baseline performance was associated with a better effect of training on driving suggesting ASD individuals require a certain level of driving skill to improve their driving performance effectively or rather that different training methods need to be used for these individuals. These findings suggest that ASD, which affects an individual's EF abilities, relates to poorer performance in a driving simulator. However, more 'typical' baseline driving performance in the simulator can improve an ASD individual's probability that training EF skills can help achieve 'typical' levels of driving performance.

##### *1.2.3.5.4 Autistic Traits*

Many researchers have argued for the existence of a more general autism phenotype that has come from research involving individuals who exhibit a higher than typical degree of autism symptomatology but who do not meet the formal diagnostic criteria. For example, Bishop et al. (2004) found that parents of autistic children scored significantly higher than parents without autistic children on the Autism Spectrum Quotient (AQ; Baron-Cohen et al., 2001), a self-report questionnaire designed to assess traits of autism symptomatology within the general population. There are plenty of studies that have assessed EF within ASD (Cox et al., 2012; Cox et al., 2016; Ross et al., 2017). However, only a small amount of studies to date have investigated the relationship between autistic traits and EF abilities. Despite this, Christ et al. (2010) split a large sample of university students into high and low autistic trait groups using scores on the Social Responsiveness Scale (Constantino, 2013) and Autistic Quotient (Baron-Cohen etal., 2006). After, they compared group membership with the subscales and index scores of the BRIEF-A (Roth et al., 2013). They successfully hypothesised that autistic trait group membership significantly predicted all BRIEF index and subscales scores excluding inhibit and organisation of materials that did not.

Another study investigating autistic traits and EF within 274 university students comes from Ferraro, Hansen, & Deling, 2018, who used similar measurements of autistic traits and EF as the previous study: Autism Spectrum Screening Questionnaire (ASSQ; Ehlers, Gillberg, & Wing, 1999), Executive Function Index (EFI; Spinella, 2005). Participants were sorted into two groups based on their ASQ scores (High and low ASQ) for analysis. They found that low ASQ individuals had greater EFI subscale scores (EFI-1, Motivational drive; EFI-4, Organisation) that high ASQ individuals. However, these groups did not differ on EFI total score and 3 other subscales (EFI-2, impulse control; EFI-3, Empathy; EFI-5, Strategic planning). Both these study's findings suggest that autistic traits are a contributing factor in varying degrees of EF abilities and should be taken into consideration when investigating a typical population. Furthermore, they also identified a gap within literature that has not yet been explored in relation to the interaction EF has on driving.

## 1.3 Hypotheses

In light of the literature reviewed above, the purpose of the present study was to investigate self-report and neuropsychological tests of EF as predictors of aberrant driving behaviour (i.e. deviating from the normal driving practice) and problematic driving outcomes, with a particular focus on self-report EF measures as an under-explored, but promising set of predictors. Furthermore, given the wide adoption of neuropsychological testing in examining executive skills, we will test the notion that self-report measures assess different aspects of EF and should be used in conjunction with neuropsychological tests. Moreover, we explored the affect possible covariates have on executive skills, aberrant driving behaviours and problematic driving outcomes. Finally, we tested theoretical conceptualisations by investigating the differences between overall self-report EF scores against specific components as predictors of aberrant driving behaviour.

The present study improved upon prior research by: 1) introducing a variety of executive measures thought to tap different aspects of EF; 2) testing the validity of EF as a predictor of aberrant driving practices and problematic outcomes; 3) considering possible covariates such as gender, anxiety and autistic traits within investigation and 4) assessing problematic driving outcomes in a driving simulator allowing for improved control over the demands of the virtual environment.

First, we hypothesised that performance on self-report executive measures would be associated and predictive of self-report aberrant driving behaviour. Second, we hypothesised that performance on neuropsychological tests of EF would be associated and predictive of problematic driving outcomes in the driving simulator. Third, we hypothesised that there would be no significant relationship between self-report and neuropsychological measures of EF as previous research states that they measure different aspects of EF (Toplak, West, & Stanovich, 2013). In addition to these hypotheses, we explored whether covariates such as gender, age, anxiety and autistic traits were associated with EF, aberrant driving behaviour or problematic driving outcomes. Lastly, we hypothesised that a self-report global EF measure would be a better predictor of aberrant driving behaviour comparative to specific components of EF.

# Method

## 2.1 Participants

In this two-part study, 71 young adults participated in the first part of the study and 22 of these individuals went on to complete the second part (17 males, 54 females; age range 18 to 26). These participants were taken predominantly from the student population at the University of Lincoln and were recruited by utilising the University's online subject pool management system (SONA). The SONA system provides each psychology student and member of the faculty an account for accessing a vast online library of all current research projects taking place at the university. Researcher accounts give members and students the opportunity to advertise their study by providing a detailed account including information such as: timeslots, dates, procedure, ethics, eligibility criteria and rewards for participation. Participant accounts allowed members to search through experiments and choose based on their interests and eligibility. If they are interested in a project, participants sign up to a free timeslot allocated by the researcher that fits with their timetable and on completion of participation rewarded with credit points.

Additionally, psychology students were required by policy to gain up to 60 credit points to qualify for a researcher account to be used in their 3rd year dissertation projects. The number of credit points issued is based on an estimate of time taken to complete the study, one point is awarded for every 15 minutes of estimated overall time of completion. For example, if the study estimated that it would take 60 minutes to complete, four credit points would be issued on completion of the study. Furthermore, absenteeism would result in no credit points being issued unless the researcher missed the timeslot rather than the participant. Therefore, the SONA system was used as a means for recruitment and organisation of participants. However, as the SONA system is only available to the members of the School of Psychology in the University of Lincoln recruitment of participants outside the school was conducted in a different manner relying upon opportunity sampling methods around the university campus.

Participants who hadn't received a full driving license accreditation or suffered from any conditions affecting their driving ability under DVLA guidelines for fitness to drive were asked not to participate in the study (Department of Transport HM Government, 2019a). This information was provided to participants throughout advertisement and reiterated during the brief on both parts of the study.

## 2.2 Materials

The study consisted of two parts, the first was an online survey that included an information sheet about the study (See Appendix 6.1), A consent form (See Appendix 6.2), debrief form (See Appendix 6.3) and five online self-report sections, which asked questions to assess a participant's demographic characteristics (See Appendix 6.4), autistic traits, anxiety, executive skills and driving behaviour. Participants of the first part of the study were invited to come to the driving simulator lab to compete the second part, which consisted of an information sheet (See Appendix 6.5), four neuropsychological EF measures and a three driving simulator tasks to assess problematic driving outcomes. Informed consent (See Appendix 6.6) and a debrief (See Appendix 6.7) was also issued when completing the second part to offer another opportunity for participants to withdraw consent, if they wished.

### 2.2.1 The Adult Autism Spectrum Quotient-10 item (AQ; Allison, Auyeung, & Baron-Cohen, 2012)

The 10 item version of the Adult Autism Spectrum Quotient was used to assess autistic traits (AQ-10; Allison et al., 2012). The AQ-10 comprises of 10 self-report items designed to measure the presence of autism as a trait within a continuous distribution in the general population (Baron-Cohen et al., 2001). Participants indicated their level of agreement or disagreement on a four-point Likert scale by circling *definitely agree, slightly agree, definitely disagree or slightly disagree.* See Appendix 6.8 for full AQ-10.

The AQ-10 was constructed by choosing two items from the original Adult Autism Spectrum Quotient (AQ;) from each of its five domains that had the largest difference between cases and controls (Allison et al., 2012). Two scoring methods are available for the data collected, the original method that counts the number of positive responses and an alternative that sums the Likert item scores (Allison et al., 2012; Baron-Cohen et al., 2010). Both methods highlight that higher scores indicate increased levels of autistic traits.

Studies on the psychometric properties of the AQ-10 remain unclear (Ruzich et al., 2015). In recent literature, the original AQ was found to be influenced by comorbidity (e.g. generalised anxiety disorder) that can ‘mimic’ ASD and inflate scores leading to false positives (Bolton et al., 2016). Because AQ-10 derives its items from the original, it is suggested that it can influenced as well. Furthermore, the validity of the AQ is threatened by differential item functioning (Rentergem et al., 2019), which is when participants that have the same levels of a trait give different answers because of their group membership. Eight negatively phrased items consistently showed differences in response tendencies between groups.

However, these items are not included in the shorter versions of the AQ, which suggests that the AQ-10 is more suitable when comparing groups (Rentergem et al., 2019). In addition to this, research by Lundin et al. (2018) investigated the validity of the AQ-10 in a public health survey with a total of 50,157 respondents. They demonstrated that the AQ-10 has adequate validity in measuring autistic traits within a general population, although they stress that some of the items may perform poorly.

Therefore, the current study utilises the AQ-10 for investigating autistic traits as there is little difference in comparison to the original in the measurement of autistic traits. It has been shown to be influenced less by negatively phrased items (Rentergem et al., 2019; Booth et al., 2013) and the validity of the AQ-10 as a measure is adequate in a general population (Lundin et al., 2018).

### 2.2.2 The State-Trait Anxiety Inventory-6 item (STAI-Y6; Marteau & Bekker, 1992)

The six-item version of the State-Trait Anxiety Inventory was used to measure the presence of state anxiety within a general population (Marteau & Bekker, 1992a). This was due to the large survey and time constraints of the original form that impacted the length and time taken to complete the online segment of the study. The STAI-Y6 consists of 6 items designed to measure the state of anxiety an individual is in when completing the measure. Participants are asked to rate their level of agreement to a series of statements about their feelings on a four-point Likert scale at the time of testing by circling *not at all, somewhat, moderately or very much.* See Appendix 6.9 for full questionnaire

The inventory’s items were ranked in order of their magnitude based on inter-remainder correlations. An equal number of items identified as anxiety present and absent were used to form the STAI-Y6. Correlations between the STAI-Y6 and the original state trait inventory ($r$ = .95) have shown that the STAI-Y6 does not deviate considerably from the measurement of the original (Marteau & Bekker, 1992a) and therefore can be used within the current research with little to no inaccuracies.

Studies on the psychometric properties of the STAI-Y6 provides evidence for its reliability as a measure (Marteau & Bekker, 1992b). The internal consistency of the measure was shown to be good, considering that reliability measurements can be influenced by the number of items within a measure (Bayrampour et al., 2014). Therefore, the current report will use the STAI-Y6 to measure state anxiety as it has been demonstrated to have similar levels of reliability and concurrent validity compared to the original (Bayrampour et al., 2014). It is a faster measure to administer relative to the full version and will solely be used to investigate any effect that state anxiety may have on driving performance or EF.

### 2.2.3 The Behaviour Rating Inventory of Executive Function-Adult Version (BRIEF-A; Roth et al., 2005)

The adult self-report version of the Behaviour Rating Inventory of Executive function (BRIEF-A; Roth et al., 2005) was used to assess EF. The BRIEF-A consists of 75 items assessing the behavioural manifestations of EF (See Appendix 6.10). Participants indicate how often each item has been a problem for them over the past month on a three-point Likert scale (“never”, “sometimes” or “often”).

The BRIEF-A has nine non-overlapping subscales theoretically and empirically derived clinical scales, two broader indices (Behavioural Regulation Index, BRI; Metacognition Index, MCI) and one global composite score (Global Executive Composite; GEC) formed from the summation of both indices. The subscales that contribute to the global and index scores include: Inhibit, Shift, Emotional Control and Self-Monitor, Initiate, Working Memory, Plan/Organise, Task Monitor, and Organisation of Materials. Total scores were obtained by the summation of subscale questions, with higher scores indicating poorer functioning within that domain of EF. Normative data from the original study was used for the conversion of these raw scores into *t*-scores.

Additionally, there are three scales to test the validity of the data: Infrequency, Inconsistency and Negativity. The Infrequency scale assesses the responses compared to a normal and clinical population. The Inconsistency scale screens for inconsistency across the answers given and the Negativity scale assesses negative response bias. No deviations from these validity scales were observed in the current thesis’ dataset.

Previous studies have demonstrated that the BRIEF-A displays solid psychometric properties including reliability, validity and clinical unity (Ciszewski et al., 2014; Gioia et al., 2002). The BRIEF-A has shown to have moderate to high internal consistency for the subscales ($\alpha = .73$ to .90), and high internal consistency for the indexes, BRI, MCI and GEC ($\alpha = .93$ to .96; Roth et al., 2005). The measure also shows great test-retest reliability, as scores over a four-week period were found to be stable with correlations ranging from $r = .82$ to .93 for the subscales, $r = .93$ for BRI and MCI, $r = .94$ for the GEC (Roth et al., 2005). Despite the BRIEF-A's great validity and reliability, research has not found correlations between neuropsychological measures of EF and the BRIEF-A (Rabin et al., 2006). However, this may suggest that the BRIEF-A is measuring a different aspect of EF compared to neuropsychological measures.

Thus, the current study utilised the BRIEF-A as it was developed to measure EF within the demographic of the current study. It has been shown to have high internal consistency for all of its indices, as well as great test-retest reliability overall (Roth et al., 2005). Furthermore, neuropsychological measures were used alongside the BRIEF-A as it has been shown to measure different aspects of EF (Rabin et al., 2006).

### 2.2.4 The Manchester Driver Behaviour Questionnaire (DBQ; Reason et al., 1990)

The DBQ exists in many different versions, where each study seems to have used a unique combination of items. In the present report, the original version of the Driver Behaviour Questionnaire developed by Reason et al., (1990), was employed in this study as it was initially designed to measure a UK driving population (See Appendix 6.11). This measure consists of 50 items that identify three factors. The first factor encompasses slips and lapses in concentration that cause embarrassment and inconvenience to their perpetrators for example, getting into the wrong lane of a roundabout, forgetting the current gear and taking the wrong exit of a roundabout. The second factor is best characterised as slips and mistakes that have a high risk of an accident occurring such as, not noticing pedestrians crossing, misjudging speed of approaching vehicle when overtaking and failing to check mirrors before a manoeuvre. The third factor consists exclusively of deliberate actions involving a definite risk to other road users including disregarding red lights, breaking the speed limits, and overtaking on the inside lane (Reason, Manstead, Stradling, et al., 1990).

Participants respond to statements describing everyday driving situations and are asked to indicate on a five-point scale the extent each statement applies to them from 0 ('never') to 5 ('nearly all the time'). Total scores for each factor are obtained by the summation of factor questions and in all instances, higher scores indicate higher frequencies of that behavioural domain.

Previous studies have demonstrated good test-retest reliability as well as strong confirmatory evidence for a predictive relationship between factors of the DBQ and an individual's history of dangerous driving and crash involvement (J. C. F. de Winter, Dodou, & Stanton, 2015).

Since its conception, the DBQ has become one of the most widely used instruments for measuring driving behaviour (Koppel et al., 2018; Af Wåhlberg et al., 2015; Winter & Dodou, 2010). Because of this, the DBQ has subsequently been translated and adapted for numerous countries including, the USA (Cordazzo et al., 2014; Cordazzo el al., 2016), Canada (Koppel et al., 2018), Australia (Davey et al., 2007), Sweden (Åberg & Wallén Warner, 2008), Greece (Kontogiannis et al., 2002), The Netherlands (Özkan et al., 2006), Spain (Eugenia Gras et al., 2006), France (Guého et al., 2014), New Zealand (Sullman, Meadows, & Pajo, 2002) and UK (Reason et al., 1990). However, the factorial structures of the DBQ as well as the number of items vary between different cultures and nations.

Therefore, the current study used the DBQ as it has been shown to accurately measure aberrant driving behaviour (i.e. deviating from the normal driving practice), it was developed using a UK driving population (Reason, Manstead, Stradling, et al., 1990), and it has been validated in its original form and other factorial solutions across different driving cultures and nations (Özkan et al., 2006). It has also shown to have great test-retest reliability and internal consistency and be predictive of dangerous driving and crash involvement (de Winter & Dodou, 2010).

### 2.2.5 The Driving Simulator

The driving simulator software utilised was named City Car Driving (Forward Development, Moscow, Russia). This enabled us to mimic the properties and 'feel' of a car in the real world as closely as possible including, fundamental forces of physics (e.g. gravity), braking, mass, and the acceleration of the car. Side and rear-view mirrors as well as a speedometer were also available on-screen to aid the driver in operating the vehicle in a safe manner. Furthermore, head-tracking was provided by the EDtracker Pro (EDtracker Ltd, Wokingham, Berkshire, United Kingdom ) to improve the field of vison available to the participants (Simulated field of view is 85°) by allowing them to orient their view via head movement, akin to naturally shifting attention in a real driving scenario (See Figure 1).


**Figure 1** *EDtracker Pro*

A custom frame design was developed to house a 2560x1080 Ultrawide monitor, a Tobii TX300 eye-tracker (to be used in further study) and a Logitech Driving Force G920 steering wheel, pedals and gear shifter to unify the simulator into one functioning unit (Logitech, Lausanne, Switzerland). Also, A driving simulator manual was developed to inform individuals about how to operate the driving simulator (See Appendix 6.16). For a picture of the driving simulator, see Figure 2.


**Figure 2** *Custom Frame Housing for Driving Simulator Equipment*

The virtual driving environments consisted of a familiarisation session and three courses, ordered by the experimenter: (a) old district of a city, (b) modern district of a city and (c) the motorway. The familiarisation session was a circuit consisting of straight roads and sharp 90° corners to develop the participants understanding of the steering, clutch, gearing, accelerator, and braking mechanisms. See Figure 3 for a screenshot of the driving environment.

The old district contained a number of potentially salient locations such as pedestrian and traffic crossings, roads with multiple lanes (up to three in certain areas), speed limit changes (50kph to 60kph) and a variety of junctions (e.g. roundabouts, T-junctions and crossroads). The modern district consisted of a similar road layout to the old however, it increased in intensity of three lane roads, added speed prevention measures (e.g. road bumps), had a larger variety of speed restrictions (20kph to 60kph) and removed roundabouts replacing them with crossroads. The motorway consisted of fast-moving traffic in four lanes, higher speed restrictions (110kph) and slip roads to enter the motorway.

Each scenario apart from the familiarisation session was set to have 50% on all levels of traffic density (i.e. vehicular traffic density, traffic behaviour and pedestrian traffic density). The car model used was an unbranded rear-wheel drive saloon with a 7-speed manual transmission gearbox (including reverse) with an anti-lock braking system. This was used due to being one of the only cars available in right-hand drive (what is used in the United Kingdom) and for having the closest resemblance to the cars used in real-life scenarios. Sessions were counterbalanced in an attempt to control for order effects that might occur when participants develop a pattern of responding that might carry over from other sessions.


**Figure 3** *Screenshot of City Car Driving (Forward Development, Moscow, Russia)*

The simulator software also tracks individual driving performance through a point-based system whereby, an individual would accumulate points based on violations of the rules of the road. For example, speeding in a restricted area, not signalling when making a manoeuvre, not giving way to pedestrians crossing the road and crossing into the opposing lane are all problematic driving outcomes. Other than this, points can also be accrued by having accidents with other road users and pedestrians.

To score the vast amount of data being collected, we focused on individual frequency of violations and errors that would have the most significant driving outcomes rather than a point-based system, which could differ in its awarding of points.

As well as this, false positives were shown in the data, so each video was checked to ensure the violation was flagged accurately and if it couldn't be determined the software was given the benefit of the doubt.

The current study used City Car Driving because of its availability globally on a digital distribution platform (i.e. Steam) for a relatively small cost. The point-based violation system is unique to this product and fits research needs well and its large variety of driving environments allows for multiple tests to be carried out.

### 2.2.6 Neuropsychological Measures of Executive Functioning

In order to assess executive function, participants completed four tasks. Together, these tasks attempt to target response inhibition, task-switching (i.e. set-shifting), working memory and attentional properties involved in driving.

#### *2.2.6.1 Working Memory*

A Digit-Span Task (DST) was used to investigate working memory ability within the current thesis' population. The assessment was administered verbally using a stopwatch to match the presentation time to the number of stimuli presented. The responses were recorded on a paper scoring template (See Appendix 6.12). The tasks are split into two stages: a forward and backward digit span task. For the first stage, the experimenter would articulate a series of digits one after the other and the participant was tasked with repeating the digits back in the same order presented (e.g. 1-3-5-7-4). If the participant recalled the digits correctly, they would be awarded a point. This would repeat for several times with the digit length incrementing up from 2 to 9. At the point the participant cannot recall the digits, the trial is over.

For the second stage of the task, the experimenter would carry out the same trial as the first with one difference, the participant would have to recall the digits in the reverse order (e.g. 4-7-5-3-1). Two trials are conducted for each stage and a composite score is collated from the total scores. This composite score is then normalised using a lookup table to find the equivalent *z*-score and percentile ranking.

#### *2.2.6.2 Task-switching*

The Trail-Making Test (TMT) was used to explore task-switching (i.e. set-shifting) capacities within participants. However not originally designed for this purpose, the test has subsequently been discovered to measure this EF by utilising ratios between the two comprising forms (A and B) and validated against a pre-existing measure of task-switching ability (Arbuthnott & Frank, 2000).

The test was administered on paper with participants given the opportunity to understand the concept with two practice examples (See Appendix 6.13). Form A consisted of circles numbered 1-25, individuals were required to draw a trail with a pen connecting each circle in a numerically ascending order (e.g. 1-2-3-4-5) while the experimenter timed from start to finish.

After this, form B was produced and a similar task asked of the participant with one exception, the circles needed to be completed in numerical and alphabetical order ascending with a distinct pattern (e.g. 1-A-2-B-3-C). During both forms, participants were prohibited from lifting their pen from the paper. Furthermore, after making a mistake during the trail the experimenter was required to point out this before allowing the participant to continue.

Completion times for both forms were documented and the difference between A and B was computed. Percentile ranks were interpreted from normative data that controls for age and educational differences (Tombaugh, 2004).

#### *2.2.6.3 Attention*

A Double Letter Cancellation Task (DLCT) was used to measure visuospatial abilities and search organisation within the population. The task was conducted on paper and consisted of 255 randomised characters organised into 5 lines with 51 characters per line (See Appendix 6.14). Participants were assigned the objective of finding two letters (C and J) as many times as they could within 60 seconds. Once they had found a letter, they were required to make a slash through the letter with the pen provided. After the time was up, the frequency of correct, incorrect, and missed letters was recorded and used as dependant variables in analysis. Higher scores indicated better performance and the test takes less than 5 minutes to administer.

There are many variations of the existing psychometric measure and consequently normative data is unavailable for most of these variants. Therefore, raw scores were used for comparisons against other variables.

#### *2.2.6.4 Inhibition*

To measure the influence of Inhibition on driving behaviour, a computerised Stroop-task was used to measure the participant’s responses. This task was carried out using a Microsoft Surface Pro 3 tablet running a python-based software program named “PsychoPy3” (version 3.0.5), which was developed by the University of Nottingham. See Appendix 6.15 for screenshots of the program.

When running the test, participants were presented with a series of words depicted in a variety of different colours. It is the task of the participant to identify the colour of the word being presented to them by pressing the corresponding keyboard button. Words and colours were limited to 3 items (e.g. red, blue and green). Colours were randomised between the nouns giving them congruency or incongruency (i.e. the colour matches the word or does not). Twelve practice trials were carried out to familiarise the participant with the format of the test. Once the individual had completed the practice trials, they were presented with the full test (e.g. 60 trials). The stimuli were presented in 500 millisecond intervals after the participant made a response.

Participant's raw response times to each stimulus were logged and used to generate a mean composite score of their overall reaction time between congruent and incongruent trials. Furthermore, mean standard deviation scores were collected to observe how much participants deviated in their reactions between trials. The test overall took less than 5 minutes to complete.

## 2.3 Procedure

The first part of the study collected data through an online survey using Qualtrics survey software (Qualtrics, Provo, UT). Participants were invited to take part from a link provided by either the experimenter through opportunity sampling methods or by the SONA participation system. Individuals were provided with an information sheet explaining the premise of the study and its reasons for investigating this phenomenon. Next, was a consent form that gave the opportunity to formally accept participation and inform participants of their right to withdrawal at any time during the studies timeline. General demographic questions were asked including some screening questions to confirm the participant's driving licensure. The AQ-10, STAI-Y6, BRIEF-A and DBQ were electronically imbedded into the survey for ease of use and availability for the participant. Also, participants were issued with a debriefing form after the survey was finished to explain in more detail the goals of the study. The survey was approximated to take a minimum of 15-20 minutes to complete, excluding any false readings such as leaving the online survey open whilst not finished.

The second part of the study involved inviting participants from the first back for a second round of testing. Once a participant displayed interest, they were asked to book a suitable timeslot to arrive in the driving simulator lab. When in the lab, individuals were given an information sheet explaining how the second session would be structured. After the participant had fully understood the information, they were asked to sign another consent form for their participation. Participants would then start a practice session designed to build familiarity with the simulator equipment by testing the participants modulation of speed and ability to turn on a test track (See Figure 4).

After three laps of the familiarisation circuit, participants were taken out of the simulator and placed in another room to consolidate their knowledge. During this time, participants were tested on four EF measures in the order that follows: Backwards Digit-Span, Trail-Making, Double Letter Cancellation and the Stroop.

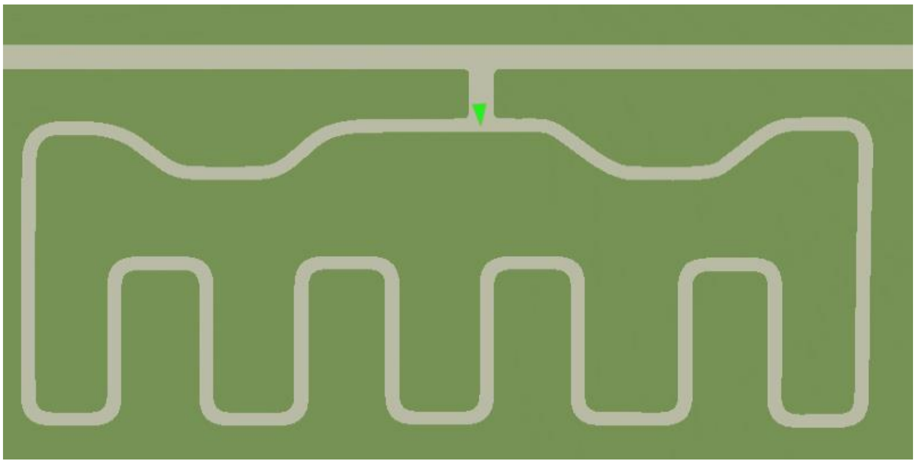


**Figure 4** *Familiarisation Circuit*

Once finished, participants were asked to complete three driving tasks in different driving environments within the simulator (e.g. motorway, old and modern districts of a city). On each task, participants were given instructions from the experimenter to follow a pre-determined route, these routes have been highlighted in red on figures 4-7. The old district environment is considered to represent a typical town's road layout with challenges such as, dual carriageways, traffic lights, roundabouts and differing speed limits depending on the area (See Figure 5).


**Figure 5** *Old District Circuit*

The modern district environment can be likened to a metropolitan area with multiple lanes of traffic, roadworks, difficult turns and varying speed limits (See Figure 6). Lastly, the motorway environment is a four-laned road with a 70-mph speed limit, slip roads leading onto the motorway and service stations to pull over at (See Figure 7). All drives were counterbalanced for half of the participant population to reduce the effect order had on the data collected.

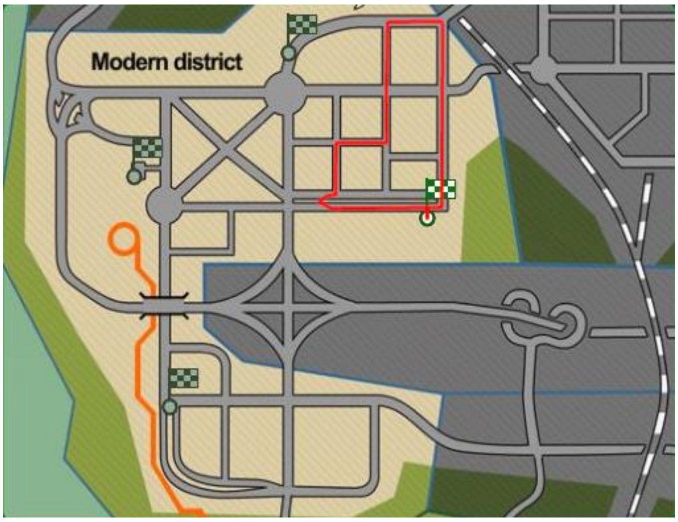



**Figure 7** *Modern District Circuit*

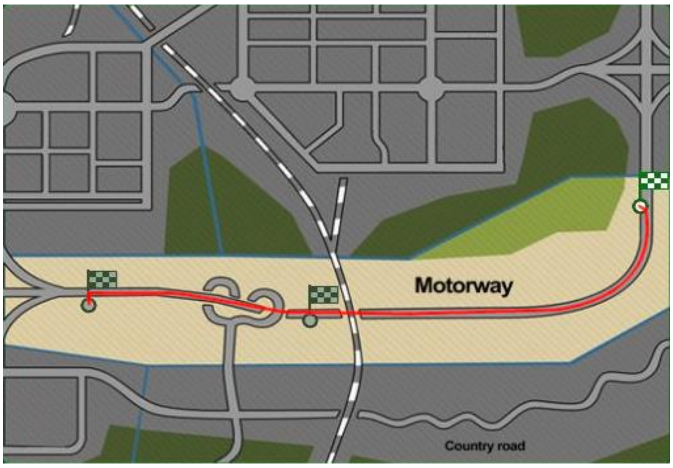



**Figure 6** *Motorway Course*

After participants had completed all three driving tasks, they were given a debriefing form and the opportunity to ask any questions about the study before they left the lab.

## 2.4 Ethical Considerations

Prior to advertisement, ethical approval was sought and obtained by the School of Psychology Ethics Committee at the University of Lincoln (See Appendix 6.17). As advised by the committee, participants were not given feedback on any measurements taken relating to their driving ability. This is for the reason of potentially discouraging participants from driving in the future. Consent forms were signed and kept in a locked filing cabinet within a controlled access laboratory. Additionally, a full debrief was given and any questions regarding the study were answered. Considerations were taken in regard to motion sickness and other discomforts by scheduling breaks between driving sessions, control over the volume and brightness of the monitor, as well as the opportunity to withdrawal from the study without consequence was also explained once more to the participant (e.g. credit points still being awarded).

# Results

## 3.1 First Part

### 3.1.1 Factor Structure of DBQ in the Current Sample

All statistical analysis within the current thesis was performed using IBM's Statistical Package for Social Sciences (IBM SPSS, Version 22 and 25). The data collected from Driver Behaviour Questionnaire was entered into a factor analysis to establish underlying linear components for use in further analysis. A principal components method with a varimax rotation was used to examine the factorability of the measures. Initial extraction revealed multiple factor loadings above an eigenvalue of 1, however the scree plot indicated that a four-factor structure was the most acceptable for the dataset. Thus, the three-factor loading of the original DBQ was not supported by this analysis (Reason et al., 1990). The four factors used within the analysis explained 45.5% of the variance overall with loadings less than 0.3 omitted for the sake of clarity. Questions 3, 22 and 27 did not load with any of the four factors and were therefore discarded.

Factor 1 (Absentminded) was comprised of 2 unintentional violations, 1 violation, 4 mistakes and 9 slips reported on a 4-point Likert scale that explained 25.7% of the variance with factor loadings from .361 to .726. Factor 2 (Close Call) was formed of 2 violations, 1 mistake and 7 slips reported on a 4-point Likert scale that explained 8.6% of the variance with factor loadings from .305 to .785. Factor 3 (Risky Driving) included 8 violations and 3 slips reported on a 4-point Likert scale that explained 6.2% of the variance with factor loadings of .317 to .752. Factor 4 (Dangerous Driving) consisted of 5 violations, 4 mistakes and 1 slip reported on a 4-point Likert scale that explained 4.8% of the variance with factor loadings of .402 to .787. Full factor loadings of the four-factor structure can be seen in Table 1 and raw output in Appendix 6.2.1.

**Table 1** *Factor structure and loadings of the DBQ items*

| DBQ items | Factors | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Q15. Forget which gear you are currently in and have to check with your hand | .726 | | | |
| Q37. Get into the wrong lane at a roundabout or approaching a road junction | .711 | | | |
| Q13. "Wake up" to realise that you have no clear recollection of the road along which you have just travelled | .669 | | | |
| Q17. Intending to drive to destination A, you "wake up" to find yourself en route to B, where the latter is the more usual journey | .644 | | | |
| Q10. Intend to switch on the windscreen wipers, but switch off the lights instead, or vice versa | .642 | | | |
| Q28 Lost in thought or distracted, you fail to notice someone waiting at a zebra crossing, or a pelican crossing light that has just turned red | .599 | | | |
| Q8 Forget where you left your car in a multi-level car park | .588 | | | |
| Q38 Fail to read the signs correctly, and exit from a roundabout on the wrong road | .571 | | | |
| Q12 Misjudge your gap in a car park and nearly (or actually) hit adjoining vehicle | .548 | | | |
| Q2 Check your speedometer and discover that you are unknowingly travelling faster that the legal limit | .483 | | | |
| Q39 Fail to give way when a bus is signalling its intention to pull out | .479 | | | |
| Q23 Lost in thought, you forget that your lights are on full beam until "flashed" by other motorists | .475 | | | |
| Q33 Plan your route badly, so that you meet traffic congestion you could have avoided | .470 | | | |
| Q45 Drive with only "half-an-eye" on the road while looking at a map, changing a cassette or radio channel, etc | .444 | | | |
| Q46 Fail to notice pedestrians crossing when turning into a side-street from a main road | .439 | | | |
| Q11 Turn left on to a main road into the path of an oncoming vehicle that you hadn't seen, or whose speed you had misjudged | .361 | | | |
| Q42 Attempt to overtake a vehicle that you hadn't noticed was signalling its intention to turn right | | .785 | | |

| | | |
|---|---|---|
| Q40 Ignore "give way" signs, and narrowly avoid colliding with traffic having right of way | .723 | |
| Q20 Try to overtake without first checking your mirror, and then get hooted at by the car behind which has already begun it's overtaking manoeuvre | .692 | |
| Q36 Cut the corner on a right-hand turn and have to swerve violently to avoid an oncoming vehicle | .650 | |
| Q34 Overtake a single line of stationary or slow-moving vehicles, only to discover that they were queuing to get through a one-lane gap or roadwork lights | .623 | |
| Q32 Fail to notice someone stepping out from behind a bus or parked vehicle until it is nearly too late | .564 | |
| Q30 Misjudge speed of oncoming vehicle when overtaking | .540 | |
| Q25 In a queue of vehicles turning left on to a main road, pay such close attention to the traffic approaching from the right that you nearly hit the car in front | .509 | |
| Q41 Fail to check your mirror before pulling out, changing lanes, turning, etc | .354 | |
| Q24 On turning left, nearly hit a cyclist who has come up on your inside | .305 | |
| Q48 "Race" oncoming vehicles for a one-car gap on a narrow or obstructed road | | .752 |
| Q47 Get involved in unofficial "races" with other drivers | | .700 |
| Q21 Deliberately disregard the speed limits late at night or very early in the morning | | .631 |
| Q7 Drive especially close or "flash" the car in front as a signal for that driver to go faster or get out of your way | | .582 |
| Q29 Park on a double-yellow line and risk a fine | | .578 |
| Q6 Attempt to drive away without first having switched on the ignition | | .532 |
| Q43 Deliberately drive the wrong way down a deserted one-way street | | .484 |
| Q35 Overtake a slow-moving vehicle on the inside lane or hard shoulder of a motorway | | .482 |
| Q14 Miss your exit on a motorway and have to make a lengthy detour | | .425 |
| Q18 Take a chance and cross on lights that have turned red | | .369 |
| Q1 Attempt to drive away from traffic lights in third gear | | .317 |

| | |
|---|---|
| Q49 Brake too quickly on a slippery road and/or steer the wrong way in a skid | .787 |
| Q19 Angered by another driver's behaviour, you give chase with the intention of giving him/her a piece of your mind | .706 |
| Q50 Misjudge your crossing interval when turning right and narrowly miss collision | .643 |
| Q31 Hit something when reversing that you had not previously seen | .634 |
| Q5 Drive as fast along country roads at night on dipped lights as on full beam | .587 |
| Q16 Stuck behind a slow-moving vehicle on a two-lane highway, you are driven by frustration to try to overtake in risky circumstances | .564 |
| Q9 Distracted or preoccupied, realise belatedly that the vehicle ahead has slowed, and have to slam on the brakes to avoid a collision | .555 |
| Q44 Disregard red lights when driving late at night along empty roads | .535 |
| Q4 Become impatient with a slow driver in the outer lane and overtake on the inside | .495 |
| Q26 Drive back from a party, restaurant, or pub, even though you realise that you may be over the legal blood-alcohol limit | .402 |

Extraction method: principal components, rotation method: varimax

### 3.1.2 Spearman Bivariate Correlational Analysis of BRIEF-A and DBQ Factors

A Spearman's correlational analysis was performed to determine the relationships between BRIEF-A subscales, index scores and DBQ factors. Multiple strong positive correlations between these variables have emerged, which are statistically significant. Starting with the Absentminded factor that correlated with Shift ($r(66) = .269$, $p = .029$), Emotional Control ($r(65) = .300$, $p = .015$), Working Memory ($r(66) = .341$, $p = .005$), Plan/Organise ($r(66) = .250$, $p = .043$), BRI ($r(66) = .312$, $p = .011$), MI ($r(66) = .310$, $p = .011$) and the GEC ($r(66) = .331$, $p = .007$). The Close Call factor showed similar correlations to the Absentminded factor with Shift ($r(65) = .287$, $p = .021$), Emotional Control ($r(64) = .286$, $p = .022$), Working Memory ($r(65) = .296$, $p = .017$), Plan/Organise ($r(65) = .246$, $p = .048$), BRI ($r(65) = .330$, $p = .007$), MI ($r(65) = .322$, $p = .012$) and the GEC ($r(65) = .355$, $p = .004$). The Risky Driving factor on the other hand only showed three significant association between the BRIEF-A subscales and index scores including, Organisation of Materials ($r(64) = .334$, $p = .007$) and MI ($r(64) = .291$, $p = .020$). Lastly, the Dangerous Driving factor showed a mixed amount of relationships with Inhibit ($r(65) = .346$, $p = .005$), Self-Monitor ($r(65) = .406$, $p = .001$), Plan/Organise ($r(65) = .312$, $p = .011$), Organisation of Materials ($r(65) = .333$, $p = .007$), BRI ($r(65) = .294$, $p = .017$), MI ($r(65) = .346$, $p = .005$) and the GEC ($r(65) = .339$, $p = .006$). Full results of the analysis can be seen in Table 2 as well as raw SPSS output in Appendix 6.2.2.

**Table 2** *Spearman Correlational Analysis Between DBQ & BRIEF-A*

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Inhibit | | | | | | | | | | | | | | | |
| 2. Shift | **.579**$^{**}$ | | | | | | | | | | | | | | |
| 3. Emotional Control | **.656**$^{**}$ | **.502**$^{**}$ | | | | | | | | | | | | | |
| 4. Self-Monitor | **.725**$^{**}$ | **.429**$^{**}$ | **.421**$^{**}$ | | | | | | | | | | | | |
| 5. Initiate | **.637**$^{**}$ | **.598**$^{**}$ | **.548**$^{**}$ | **.395**$^{**}$ | | | | | | | | | | | |
| 6. Working Memory | **.680**$^{**}$ | **.744**$^{**}$ | **.432**$^{**}$ | **.560**$^{**}$ | **.658**$^{**}$ | | | | | | | | | | |
| 7. Plan/Organise | **.642**$^{**}$ | **.614**$^{**}$ | **.433**$^{**}$ | **.589**$^{**}$ | **.747**$^{**}$ | **.768**$^{**}$ | | | | | | | | | |
| 8. Task-Monitor | **.668**$^{**}$ | **.637**$^{**}$ | **.443**$^{**}$ | **.516**$^{**}$ | **.725**$^{**}$ | **.748**$^{**}$ | **.786**$^{**}$ | | | | | | | | |
| 9. Org. of Materials | **.363**$^{**}$ | .114 | .183 | .302$^{*}$ | **.361**$^{**}$ | **.406**$^{**}$ | **.462**$^{**}$ | **.390**$^{**}$ | | | | | | | |
| 10. BRI | **.889**$^{**}$ | **.747**$^{**}$ | **.858**$^{**}$ | **.709**$^{**}$ | **.672**$^{**}$ | **.693**$^{**}$ | **.648**$^{**}$ | **.644**$^{**}$ | .262$^{*}$ | | | | | | |
| 11. MI | **.699**$^{**}$ | **.658**$^{**}$ | **.487**$^{**}$ | **.561**$^{**}$ | **.825**$^{**}$ | **.859**$^{**}$ | **.907**$^{**}$ | **.849**$^{**}$ | **.643**$^{**}$ | **.696**$^{**}$ | | | | | |
| 12. GEC | **.866**$^{**}$ | **.752**$^{**}$ | **.726**$^{**}$ | **.678**$^{**}$ | **.823**$^{**}$ | **.840**$^{**}$ | **.842**$^{**}$ | **.818**$^{**}$ | **.491**$^{**}$ | **.914**$^{**}$ | **.918**$^{**}$ | | | | |
| 13. Absentminded | .226 | .269$^{*}$ | .300$^{*}$ | .112 | .191 | **.341**$^{**}$ | .250$^{*}$ | .175 | .113 | .312$^{*}$ | .310$^{*}$ | **.331**$^{**}$ | | | |
| 14. Close Call | .227 | .287$^{*}$ | .286$^{*}$ | .166 | .239 | **.296**$^{**}$ | .246$^{*}$ | .241 | .181 | **.330**$^{**}$ | .311$^{*}$ | **.355**$^{**}$ | **.558**$^{**}$ | | |
| 15. Risky Driving | .170 | .084 | .110 | .212 | .222 | .089 | .239 | .140 | **.344**$^{**}$ | .152$^{*}$ | .291$^{*}$ | .241 | **.380**$^{**}$ | **.418**$^{**}$ | |
| 16. Dangerous Driving | **.346**$^{**}$ | .215 | .100 | **.406**$^{**}$ | .152 | .235 | .312$^{*}$ | .160 | **.333**$^{**}$ | .294$^{*}$ | **.326**$^{**}$ | **.339**$^{**}$ | **.459**$^{**}$ | **.348**$^{**}$ | **.557**$^{**}$ |

$^{**}$ **Correlation is Significant at the 0.01 level (2-tailed).**

$^{*}$ Correlation is Significant at the 0.05 level (2-tailed).

### 3.1.2 Consideration of Covariates

In order to determine potential covariates, the relationship between demographic characteristics, STAI and AQ total score against BRIEF-A and DBQ scores were examined through Spearman's bivariate correlations. This analysis revealed that a range of relationships exist between the demographic characteristics, STAI total score, AQ total score and the BRIEF-A. For example, previous participation in a road traffic collision (RTC) positively correlated with difficulty on the emotional control subscale in the BRIEF-A [$r$ = .304, $p$ < .012]. STAI scores were positively correlated with Inhibit [$r$ = .256, $p$ <

.035], Emotional Control [$r = .281$, $p < .021$], Initiate [$r = .350$, $p < .003$] and Task Monitor [$r = .285$, $p < .019$]. Also, AQ total score indicated a number of positive correlations including, Inhibit [$r = .408$, $p < .001$], Shift [$r = .462$, $p < .0001$], Self-monitor [$r = .356$, $p < .003$], Initiate [$r = .279$, $p < .020$], Working memory [$r = .399$, $p < .001$], Plan/Organise [$r = .399$, $p < .001$] and Task monitor [$r = .307$, $p < .010$]. In addition to this, analysis also revealed correlations between demographic characteristics, STAI total score, AQ total score and the DBQ factors. For example, gender had a significantly negative impact on the Absentminded factor [$r = -.353$, $p < .004$], previous participation in an RTC was significantly negative correlated with the Dangerous Driving factor [$r = -.279$, $p < .026$] and STAI total score had a significantly negative relationship with the Dangerous Driving factor [$r = -.296$, $p < .017$]. Thus, these variables will need to be controlled for when investigating the relationship between the DBQ and BRIEF-A as these variables have the potential to confound results. Raw output of this analysis is provided within Appendix 6.2.3.

### 3.1.4 Partial Correlational Analysis Controlling for Covariates

From discovering that certain demographic characteristics and other measures affect the BRIEF-A and DBQ, a partial correlational analysis was selected to control for these extraneous variables, which could potentially mask relationships not found by ‘normal’ Spearman’s correlational analysis. One of the assumptions made in partial correlational analysis is that the control variable needs to have a linear relationship between both the dependant variable (DV) and the independent variable (IV). Thus, variables with a semi-partial relationship between either the IV or DV such as, gender, age and AQ were omitted but were included in further regression analysis.

A partial correlational analysis was run to determine the relationship between the Absentminded factor and the Emotional Control subscale from the BRIEF-A whilst controlling for participation within a road traffic collision and STAI total score. There was a moderate, positive correlation between the Absentminded factor and Emotional control whilst controlling for these two confounding variables, which was statistically significant ($r(58) = .294$, $n = 62$, $p < .026$). Zero-order correlations showed that there was a large change in significance between the Dangerous Driving factor and Emotional Control ($r(60) = .107$, n= 62, $p = .407$), indicating that previous participation in a road traffic collision and anxiety scores from the STAI have a large influence in controlling for the relationship between the Absentminded factor and Emotional Control.

Following on from this, another partial correlation analysis was conducted to determine the relationship between the Dangerous Driving factor and the three subscales and two composite scores from the BRIEF-A whilst controlling for STAI total score. Significant positive correlations were found between the Dangerous Driving factor and Inhibit ($r(61) = .439$, $n = 64$, $p < .001$), Initiate ($r(61) = .388$, $n = 64$, $p < .002$) and Task-monitor ($r(61) = .371$, $n = 64$, $p < .003$) whilst controlling for STAI total score. In addition to this, Global Executive Composite ($r(61) = .503$, $n = 64$, $p < .001$) and the Behaviour Regulation Index ($r(61) = .413$, $n = 64$, $p < .001$) had larger significance. Zero-order correlations showed that there was a significant change in subscales between the Dangerous Driving factor, Initiate ($r(62) = .214$, n= 64, $p = .090$) and Task-monitor ($r(62) = .240$, n= 64, $p = .056$), indicating that anxiety scores from the STAI have an influence in the relationship between the Dangerous Driving factor and Emotional Control. Full results from this analysis are displayed in Table 3 as well as raw SPSS output is available in Appendix 6.2.4.

**Table 3** *Partial Correlational Analysis Between BRIEF-A Subscales, Index Scores and the Dangerous Driving Factor Controlling for STAI Total Score*

| Variables | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1. Dangerous Driving | | | | | |
| 2. Inhibit | **.439****| | | | |
| 3. Initiate | **.388**** | **.560**** | | | |
| 4. Task-Monitor | **.371**** | **.593**** | **.694**** | | |
| 5. BRI | **.413**** | **.837**** | **.638**** | **.642**** | |
| 6. GEC | **.503**** | **.802**** | **.819**** | **.813**** | **.901**** |

** **Correlation is Significant at the 0.01 level (2-tailed).**

* Correlation is Significant at the 0.05 level (2-tailed).

### 3.1.5 Multiple Linear Regression Analysis

Correlational analyses revealed a range of significant correlations between the BRIEF-A subscales, index scores and DBQ factors, these relationships were studied further with the use of a linear multiple regression analysis using the enter method. A stepwise method was not suitable for this analysis as it would discard any independent variable (IV) that competed too closely with the predicting of the dependant variable (DV), even if it contributed to a significant amount of the variance within the model. Therefore, the enter method was used to control for all variables that contributed to the prediction of each DBQ Factor without discarding variables. Each DBQ factor was entered as the DV and the BRIEF-A subscales or the Global Executive Composite (GEC) alongside control variables such as, gender, previous participation in a road traffic collision, STAI total score and AQ total score were initially entered as IVs. After inspecting the regression model, control variables that did not reach significance within the coefficients table were omitted and the regression recalculated. Normality testing was conducted with all regression analyses in both experiments (first and second) and showed mostly non-significant results. When normality testing did fail, studentised residuals were plotted on a histogram and were either deemed to follow a bell curve with some minor skewness and kurtosis or investigated for outliers. Furthermore, A bootstrap method with 10,000 samples was applied to each regression equation with Bias Corrected Accelerated (BCa) confidence intervals.

#### *3.1.5.1 Regression Between BRIEF-A Subscales and DBQ Factors*

The first regression was calculated to predict Absentminded factor scores based on the BRIEF-A subscales, gender, previous participation in a road traffic collision (RTC), STAI total score and AQ total score. A regression equation was found to explain a significant amount of the variance in the Absentminded factor (F(13, 49) = 2.193, $p < .024$, $R^2 = .368$, $\Delta R^2 = .20$). This regression equation was recalculated without previous participation in an RTC and STAI total score to improve the effectiveness of the model's prediction as they did not significantly predict Absentminded scores within the coefficients table (F(11, 53) = 2.744, $p < .007$, $R^2 = .363$, $\Delta R^2 = .231$). The analysis showed that only Gender ($\beta$ = -11.004, $t(64) = -3.482$, $p < .001$) and Working Memory ($\beta$ = .441, $t(64) = 2.266$, $p < .028$, 95% CI [.051, .832]) significantly predicted the Absentminded scores. However, when interpreting the bootstrap coefficients table, Working Memory does pass significance but only by an incredibly small margin and when looking at the BCa confidence intervals they show incredible variability in Beta values ($p < .050$, BCa 95% CI [.019, .977]). Therefore, this result should be considered to accept the Null hypothesis despite passing significance testing. Full raw SPSS output can be seen in Appendix 6.2.5.

The second regression was calculated to predict Close Call factor scores based on the BRIEF-A subscales, gender, previous participation in an RTC, STAI total score and AQ total score. A regression equation was not found to be significant when predicting Close Call scores on the DBQ ($F(13, 48) = 1.203$, $p < .307$, $R^2 = .246$, $\Delta R^2 = .041$). Full raw SPSS output can be seen in Appendix 6.2.5.

The third regression was calculated to predict Risky Driving factor scores based on the BRIEF-A subscales, gender, previous participation in an RTC, STAI total score and AQ total score. A regression equation was found to explain a significant amount of the variance in the Risky Driving factor ($F(12, 47) = 2.141$, $p < .029$, $R^2 = .372$, $\Delta R^2 = .198$). This regression equation was recalculated without Gender, previous participation in an RTC and AQ total score leaving STAI total score to improve the effectiveness of the model's prediction ($F(10, 51) = 2.682$, $p < .010$, $R^2 = .345$, $\Delta R^2 = .216$). The analysis shows that STAI scores ($\beta = -.205$, $t(61) = -2.622$, $p < .012$, 95% CI [-.361, -.048]), Self-monitor ($\beta = .161$, $t(61) = 2.003$, $p < .050$, 95% CI [.000, .321]) and Organisation of Materials ($\beta = .186$, $t(61) = 2.484$, $p < .016$, 95% CI [.036, .336]) did significantly predict Risky Driving scores. However, when interpreting the bootstrap coefficients table, only Organisation of Materials was shown to hold its significance but this result should be taken with caution as confidence intervals show that the beta value has the potential to be non-significant ( $p < .018$, BCa 95% CI [-.003, .394]). Full raw SPSS output can be seen in Appendix 6.2.5.

The last regression was calculated to predict the Dangerous Driving factor scores based on the BRIEF-A subscales, gender, previous participation in an RTC, STAI total score and AQ total score. A regression equation was found to explain a significant amount of the variance in the Dangerous Driving factor ($F(13, 48) = 5.379$, $p < .001$, $R^2 = .593$, $\Delta R^2 = .483$). This regression equation was recalculated without gender and previous participation in an RTC leaving STAI and AQ total score to improve the effectiveness of the model's prediction ($F(11, 51) = 5.357$, $p < .001$, $R^2 = .536$, $\Delta R^2 = .436$). The analysis shows that STAI total score ($\beta$ = -.170, $t(62)$ = -2.479, $p$ < .017, 95% CI [-.308, -.032]), AQ total score ($\beta$ = -.613, $t(62)$ = -2.704, $p$ < .009, 95% CI [-1.069, -.158]), Shift ($\beta$ = .172, $t(62)$ = 2.250, $p$ < .029, 95% CI [.019, .326]), Self-monitor ($\beta$ = .153, $t(62)$ = 2.267, $p$ < .028, 95% CI [.017, .288]), Working Memory ($\beta$ = -.226, $t(62)$ = -2.440, $p$ < .018, 95% CI [-.412, -.040]) and Organisation of Materials ($\beta$ = .236, $t(62)$ = 3.747, $p$ < .001, 95% CI [.109, .362]) did significantly predict Dangerous Driving factor scores. However, when interpreting the bootstrap coefficients table, Only STAI total score ( $p$ < .020, BCa 95% CI [-.299, -.014]) and Organisation of Materials ( $p$ < .007, BCa 95% CI [.094, .351]) rejected the null hypothesis. By looking at the bootstrapped confidence intervals Organisation of Materials seems to show a higher confidence of an effect on Dangerous Driving factor scores. Full raw SPSS output can be seen in Appendix 6.2.5.

In summary, regression analysis has shown that EF abilities identified by the BRIEF-A subscales alongside demographic and other scales (i.e. STAI and AQ) can significantly predict aberrant driving behaviour (i.e. deviating from the normal driving practice) in three of the four factors identified in the DBQ. However, only Organisation of Materials and the Dangerous Driving factor has been shown to predict scores separately from all BRIEF-A subscales.

#### *3.1.5.2 Regressions Between BRIEF-A Global Executive Composite and DBQ Factors*

Secondary analysis was conducted between the BRIEF-A Global Executive Composite (GEC) and DBQ factors to determine if overall EF abilities were a more effective predictor of the DBQ factors. Similarly, the enter method was used within this analysis to control for all variables that contribute to overall DBQ factor scores.

The first regression was calculated to predict the Absentminded factor scores based on the BRIEF-A GEC, gender, previous participation in a road traffic collision (RTC), STAI total score and AQ total score. The regression equation was found to explain a significant amount of the variance in the Absentminded factor ($F(5, 58)$ = 4.767, $p$ =.001, $R^2$ = .540, $\Delta R^2$ = .230). This regression equation was recalculated without AQ total score and previous participation in an RTC to improve the effectiveness of the model's prediction ($F(3, 61)$ = 7.791, $p$ < .001, $R^2$ = .526, $\Delta R^2$ = .241). The analysis shows that gender ($\beta$ = -9.094, $t(64)$ = -3.182, $p$ < .002), STAI total score ($\beta$ = -.304, $t(64)$ = -2.422, $p$ < .018, 95%

CI [-.555, -.053]) and GEC ($\beta$ = .408, $t(64)$ = 3.731, $p$ < .001, 95% CI [.189, .626]) did significantly predict Dangerous Driving factor scores. When interpreting the bootstrap coefficients table, gender ( $p$ < .002, BCa 95% CI [-14.359, -.3.577), STAI ( $p$ < .035, BCa 95% CI [-.602, -.018]) and GEC ( $p$ = .001, BCa 95% CI [.162, .657]) rejected the null hypothesis. From examining the bootstrapped confidence intervals, the lower bound of STAI total score shows the potential for a non-significant effect compared to the GEC, which consistently demonstrates a larger effect size even at its minimum $\beta$ value (e.g. for every increment of Absentminded score on the DBQ, GEC increases by a minimum of .162). Full raw SPSS output can be seen in Appendix 6.2.5.

The second regression was calculated to predict Close Call factor scores based on the BRIEF-A GEC, gender, previous participation in an RTC, STAI total score and AQ total score. The regression equation was found to explain a significant amount of the variance in the Close Call factor ($F(5, 57) = 2.557$, $p$ < .037, $R^2$ = .183, $\Delta R^2$ = .112). ). This regression equation was recalculated without STAI total score, previous participation in an RTC and Gender to improve the effectiveness of the model's prediction ($F(2, 62) = 6.541$, $p$ < .003, $R^2$ = .174, $\Delta R^2$ = .148). The analysis shows that AQ total score ($\beta$ = -.486, $t(64)$ = -2.246, $p$ + .031, 95% CI [-.919, -.053]) and GEC ($\beta$ = .192, $t(64)$ = 3.508, $p$ = .001, 95% CI [.082, .301]) did significantly predict Close Call factor scores. When interpreting the bootstrap coefficients table, AQ total score ($p$ < .031, BCa 95% CI [-.939, .-.004]) and GEC ($p$ < .003, BCa 95% CI [.076, .301]) rejected the null hypothesis. From examining the BCa confidence intervals, caution should be taken when drawing conclusions about AQ total score as it shows a wide potential minimum and maximum beta values (-.939 to -.004). Thus, it is not possible to know for certain if there is a large enough effect to make a difference to Close Call scoring. Full raw SPSS output can be seen in Appendix 6.2.5.

The third regression was calculated to predict the Risky Driving factor scores based on the BRIEF-A GEC, gender, previous participation in an RTC, STAI total score and AQ total score. The regression equation was found to explain a significant amount of the variance in the Risky Driving factor ($F(5, 56)$ = 2.754, $p$ < .027, $R^2$ = .197, $\Delta R^2$ = .126). This regression equation was recalculated without AQ total score, previous participation in an RTC and Gender to improve the effectiveness of the model's prediction ($F(2, 60) = 5.083$, $p < .009$, $R^2 = .145$, $\Delta R^2 = .116$). The analysis shows that STAI total score ($\beta = -.172$, $t(62) = -2.347$, $p < .022$, 95% CI [-.318, -.025]) and GEC ($\beta = .183$, $t(62) = 2.859$, $p < .006$, 95% CI [.055, .311]) did significantly predict Risky Driving factor scores. When interpreting the bootstrap coefficients table, GEC ($p < .011$, BCa 95% CI [.052, .309]) and STAI total score ($p < .042$, BCa 95% CI [-.352, -.025]) were able to hold their significance and reject the null hypothesis. Full raw SPSS output can be seen in Appendix 6.2.5.

The last regression was calculated to predict Dangerous Driving factor scores based on the BRIEF-A GEC, gender, previous participation in an RTC, STAI total score and AQ total score. The regression equation was found to explain a significant amount of the variance in the Dangerous Driving factor ($F(5, 57) = 8.248$, $p < .001$, $R^2 = .420$, $\Delta R^2 = .369$). However, this model failed tests for normality with large skew within plots using studentized residuals compared with other regressions. This was due to a significant outlier being included within regression models that was subsequently omitted. Once removed a normally distributed dataset emerged with tests and plots accurately showing this (See Appendix 6.2.5). The regression equation was then recalculated without AQ total score, previous participation in an RTC and Gender to improve the effectiveness of the model's prediction ($F(2, 60) = 14.550$, $p < .001$, $R^2 = .327$, $\Delta R^2 = .304$). The analysis showed that STAI total score ($\beta = -.219$, $t(62) = -4.342$, $p < .001$, 95% CI [-.320, -.118]) and GEC ($\beta = .204$, $t(62) = 4.596$, $p < .001$, 95% CI [.115, .293]) did significantly predict  Dangerous Driving factor scores. When interpreting the bootstrap coefficients table, STAI total score ($p < .001$, BCa 95% CI [-.329, -.097]) and GEC ($p < .001$, BCa 95% CI [.101, .298]) were able to hold their significance to reject the null hypothesis. When inspecting the confidence intervals of both variables, they show a large minimum effect size, which suggests that they have a significant impact on the Dangerous Driving factor. Full raw SPSS output can be seen in Appendix 6.2.5.

In summary, regression analysis revealed that global executive composite scores were the best overall predictor of DBQ factor scores. STAI total score also influenced factor scores however, these results need further clarification as they show either minimal or a significant effect in different cases of aberrant driving behaviour (i.e. deviating from the normal driving practice).

## 3.2 Second Part

### 3.2.1 Spearman Bivariate Correlational Analysis Between Neuropsychological Tests of Executive Function and Problematic Driving Outcomes in the Driving Simulator

A Spearman's correlational analysis was performed to determine the relationships between neuropsychological tests of EF and problematic driving outcomes in the driving simulator. Multiple correlations appeared between these variables, which have shown to be statistically significant. Starting with stroop task performance that correlates with times participants went off road in the driving simulator ($r(23) = .574$, $p = .004$) and number of times right of way was violated ($r(23) = .439$, $p = .036$). Double letter cancellation net score was positively linked with times participant collided with pedestrians ($r(24) = .431$, $p = .036$) and times right of way was violated ($r(24) = .408$, $p = .048$). Lastly, one significant negative correlation was found between trail making task performance and number of times participants ran red lights ($r(24) = -.406$, $p = .049$). Full results of the analysis can be seen in Table 6 as well as raw SPSS output in Appendix 6.2.6.

**Table 4** *Spearman Correlations Between Neuropsychological EF Measures & Problematic Driving Outcomes*

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Digit Span | | | | | | | | | | | | | | | |
| 2. Trail Making | -.001 | | | | | | | | | | | | | | |
| 3. Stroop | -.084 | -.288 | | | | | | | | | | | | | |
| 4. Double letter cancellation | .277 | -.128 | .150 | | | | | | | | | | | | |
| 5. Did not signal | .175 | -.062 | .081 | .309 | | | | | | | | | | | |
| 6. Went off the road | -.066 | -.294 | **.574**** | .276 | .318 | | | | | | | | | | |
| 7. Opposing lane | .075 | .207 | -.052 | .229 | .450* | .240 | | | | | | | | | |
| 8. Crossed solid line | -.061 | -.024 | .221 | -.154 | .262 | .202 | .286 | | | | | | | | |
| 9. Broke speed limit | .045 | -.028 | -.114 | -.102 | -.077 | -.108 | -.275 | -.089 | | | | | | | |
| 10. Traffic collision | -.024 | -.018 | -.068 | -.186 | .310 | .350 | .013 | -.030 | .294 | | | | | | |
| 11. Pedestrian collision | .220 | -.209 | .389 | .431* | .427* | .468* | .312 | .100 | -.029 | .116 | | | | | |
| 12. Not yielding to pedestrian | .095 | -.143 | .117 | .049 | .110 | .240 | .387 | .509* | -.058 | -.118 | .348 | | | | |
| 13. Stopped on top of pedestrian crossing | -.084 | .300 | .183 | -.223 | -.259 | -.109 | .036 | -.105 | -.216 | -.242 | -.020 | .128 | | | |
| 14. Violated right of way | .224 | -.097 | .439* | .408* | .146 | .208 | -.053 | -.179 | -.078 | -.320 | .173 | -.181 | -.173 | | |
| 15. Ran red light | .005 | -.406* | .257 | .371 | .202 | .344 | .008 | .138 | .037 | .035 | -.053 | .177 | -.303 | .363 | |

**** Correlation is Significant at the 0.01 level (2-tailed).**

* Correlation is Significant at the 0.05 level (2-tailed).

### 3.2.2 Consideration of Covariates

To determine potential covariates, associations between demographic characteristics, STAI, AQ total score against neuropsychological tests of EF and frequency of problematic outcomes in the driving simulator was assessed through Spearman's bivariate correlational analysis (See Appendix 6.2.3). This analysis revealed three major relationships that exist between these variables including, previous participation in a road traffic collision (RTC) and stroop task performance [$r = .452$, $p < .027$], Age and times participants broke the speed limit [$r = .482$, $p < .017$], and AQ total score correlating with frequency of right of way violations. A trend was shown between Gender and Stroop task performance however, this result did not reach significance [$r = -.393$, $p = .052$]. This analysis has revealed several semi-partial relationships that cannot be controlled for in partial correlational analysis. Therefore, partial correlational analysis will not be used to investigate the relationship between neuropsychological tests of EF and problematic driving outcomes in the driving simulator. However, semi-partial correlations can be controlled for when performing multiple regression analysis.

### 3.2.4 Multiple Regression Analysis

The preceding analysis revealed four major correlations in regard to problematic driving outcomes that will be examined further with the use of a linear multiple regression analysis using the enter method. The four driving simulator variables, times when participants went off road, collided with pedestrians, violated right of way and ran red lights were entered as the dependant variables (DV) and stroop task, double letter cancellation and trail making scores alongside age, participation in a road traffic collision (RTC) and AQ total score were entered as independent variables (IVs). Furthermore, A bootstrap method with 10,000 samples was applied to each regression equation with Bias Corrected Accelerated (BCa) confidence intervals.

#### *3.2.4.1 Regression Between Number of Times Participants went Off-road and Stroop task Performance*

The first regression was calculated to predict the number of times participants went off-road based on stroop task performance, age, previous participation in RTCs and AQ total score. The regression equation was not found to explain number of times participants went off-road ($F(4, 17) = .606$, $p < .664$, $R^2 = .125$, $\Delta R^2 = -.081$). See Appendix 6.2.6 for raw SPSS output.

#### *3.2.4.2 Regression Between Collisions with Pedestrians and Double Letter Cancellation Performance*

The second regression was calculated to predict pedestrian collisions based on double letter cancellation task performance, age, previous participation in RTCs and AQ total score. The regression equation was found not to be significant in predicting pedestrian collisions within the simulator ($F(4, 18) = 1.575$, $p < .224$, $R^2 = .509$, $\Delta R^2 = .259$). In summary, two neuropsychological tests did show a correlation between simulated problematic driving outcomes. However, further multiple regression analysis has revealed that only one relationship could predict a singular driving outcome, this relationship was between stroop task performance and right of way violations. See Appendix 6.2.6 for raw SPSS output.

#### *3.2.4.3 Regression Between Right of Way Violations, Stroop and Double Letter Cancellation Task Performance*

The third regression was calculated to predict right of way violations based on stroop and double letter cancellation performance alongside age, previous participation in RTCs and AQ total score. The regression equation was found not to be significant in predicting right of way violations ($F(5, 16) = 2.744$, $p < .056$, $R^2 = .462$, $\Delta R^2 = .293$). However, the regression equation was recalculated without previous participation in an RTC, age and double letter cancellation performance and showed to be a significant model of prediction ($F(2, 20) = 6.528$, $p = .007$, $R^2 = .395$, $\Delta R^2 = .334$). The analysis shows that AQ total score ($\beta = -.154$, $t(22) = -2.145$, $p < .044$, 95% CI [-.304, -.004]) and stroop task performance ($\beta = 8.680$, $t(22) = 2.561$, $p = .019$, 95% CI [1.610, 15.103]) significantly predict right of way violations. However, only stroop task performance was found to be significant after being bootstrapped with 10000 samples ($p < .005$, BCa 95% CI [2.354, 15.103]). See Appendix 6.2.6 for raw SPSS output.

#### *3.2.4.4 Regression Between Times Participants Ran Red Lights and Trail-Making Task Score*

The fourth regression was calculated to predict the number of times participants ran red lights based on the trail making task alongside age, previous participation in RTCs and AQ total score. The regression equation was not found to explain number of times participants ran red lights ($F(4, 18) = 1.040$, $p = .414$, $R^2 = .188$, $\Delta R^2 = .007$). See Appendix 6.2.6 for raw SPSS output.

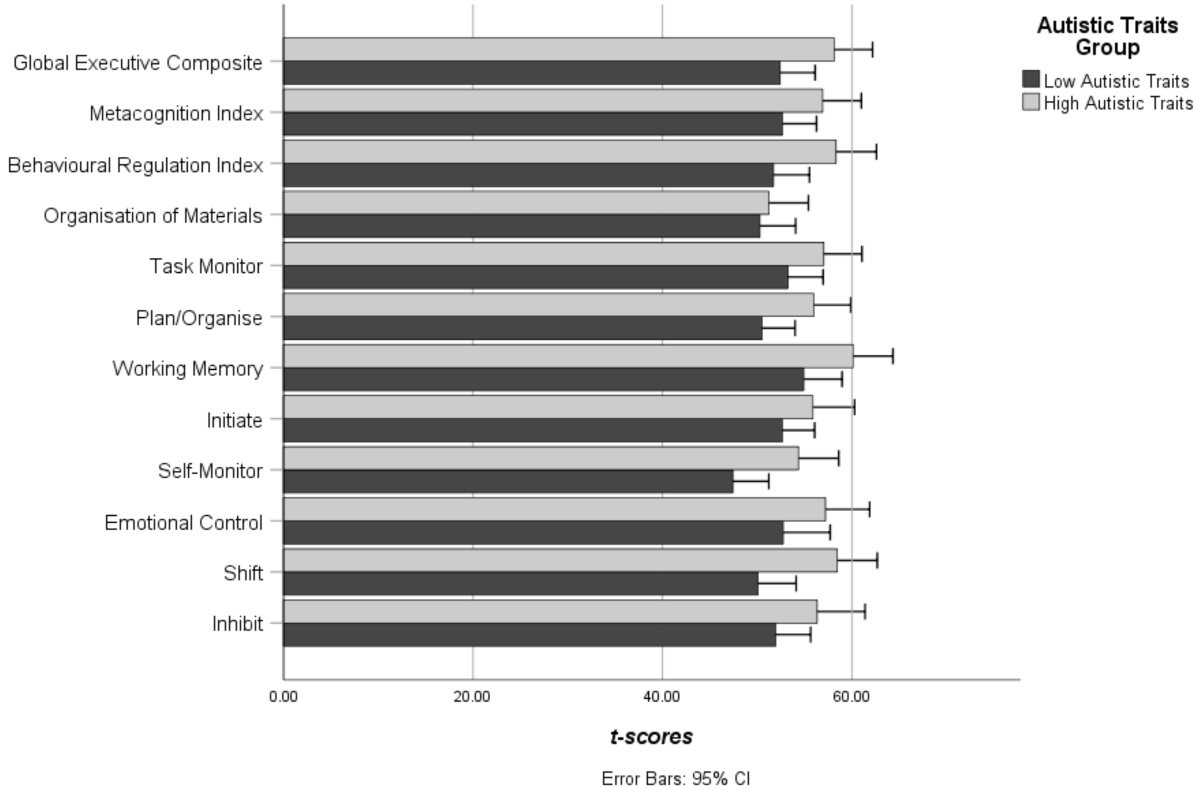
## 3.3 Analysis Between Both Parts

### 3.3.1 Correlational Analysis Across Experiments

Spearman's correlational analysis was used to investigate the potential for associations between self-report, neuropsychological tests and problematic driving outcomes between experiments. The first analysis focussed on the relationships between the BRIEF subscales, index scores and problematic driving outcomes within the driving simulator. Significant negative correlations were observed between number of times participants stopped on a pedestrian crossing and Self-Monitor ($r(24) = -.501$, $p < .013$), Initiate ($r(24) = -.433$, $p < .035$), Working Memory ($r(24) = -.418$, $p < .042$) and Plan/organise ($r(24) = -.507$, $p < .012$). In addition to this, a negative relationship was found between collisions with pedestrians within the driving simulator and Organisation of Materials ($r(24) = -.413$, $p < .045$).

The second analysis focused on the relationships between the four DBQ factors and problematic driving outcomes within the driving simulator. Only two significant correlations were found between times not signalling before a manoeuvre and the Risky Driving factor ($r(23) = .462$, $p < .026$). The second association was between the amount of times participants drove in the opposing lane and the Absentminded factor ($r(23) = -.446$, $p < .033$). The third analysis focused on the associations between the BRIEF-A subscales, index scores and neuropsychological tests of EF. The only correlation found to be significant was among Organisation of Materials and Trail making task B-A score ($r(26) = .500$, $p < .009$). The last analysis centred on the relationship between DBQ factors and neuropsychological tests of EF however, no correlations were found between these variables. See Appendix 6.2.6 for raw SPSS output.

## 3.4 Executive Function Differences in High and Low Autistic Trait Individual's




Additional independent samples *t*-tests were carried out to verify previous studies notions of differences in high and low autistic trait individuals in EF abilities. Normality testing was done to confirm a normal distribution was present between groups in relation to the BRIEF-A subscales and index scores before

**Figure 8** *High and Low Autistic Traits Groups Mean T-Scores*

*t*-tests were conducted. Normality tests revealed that Inhibit, Shift and Self-monitor subscales did not follow a normal distribution while the rest did conform to the bell curve thus, caution is recommended when inferring from these three scales in relation to autistic traits (See Appendix 6.2.7).

Significant differences were discovered between a large proportion of the BRIEF-A subscales and index scores. Higher autistic traits in participants produced higher scores overall compared to low autistic traited individuals (See Figure 4). The difference in means showed significance between Shift ($t(67) = -2.910$, $p = .005$, 95% CI [-14.08, -2.62]), Self-monitor ($t(67) = -2.473$, $p = .016$, 95% CI [-12.51, -1.33]), Plan/Organise ($t(67) = -2.124$, $p = .037$, 95% CI [-10.58, -.32]) , Behavioural Regulation Index (BRI; $t(67) = -2.356$, $p = .021$, 95% CI [-12.20, -1.01]) and the Global Executive Composite (GEC; $t(67) = -2.112$, $p = .038$, 95% CI [-11.06, -.311]). Other subscales did not pass significance however when looking at Figure 1 there is a general trend of improvement in individuals with low autistic traits as the larger values on the BRIEF-A exhibit more executive difficulties. Raw SPSS output of this analysis can be found in Appendix 6.2.7.

# Discussion

The present study was designed to investigate the relationship that self-report EF measures have on aberrant driving behaviour (i.e. deviating from the normal driving practice) as well as the association neuropsychological tests of EF have with problematic driving outcomes in a driving simulator. Furthermore, Given the variability of measures in executive skills between neuropsychological tests and self-report questionnaires within literature, it is expected that that they would assess different areas of EF (Toplak et al., 2013). We also hypothesised that, similar to prior research co-variates such as gender, anxiety, and autistic trait scores would explain a certain amount of variance in EF measures and driving within analysis. Considering the theoretical nature of EF, another goal of the present study was to explore how unitary EF is as a construct by examining whether self-reported general EF was more predictive of aberrant driving behaviours (i.e. atypical driving behaviour) than specific components of EF. To our knowledge, the current study is one of few conducting examinations of both self-report and neuropsychological measures alongside driving simulation performance in undergraduate students. Furthermore, it is among a small number of investigations utilising both overall EF and specific EF component ability.

## 4.1 Extraction of Driving Components

Though this was not the primary aim of the study, principal components analysis was conducted using scores from the Driver Behaviour Questionnaire (DBQ; Reason et al., 1990) and was reduced to individual factors. Similar to other factor analytic studies (Winter & Dodou, 2010), our data clustered into 4 primary factors, Absentminded (loadings of scenarios of inattention and unawareness), Close Call (Loadings of scenarios when the driver has almost been involved in a dangerous situation), Risky Driving (Loadings of scenarios when the driver has deliberately taken unnecessary risk) and Dangerous Driving (Loadings of scenarios with a mixture of unlawful and potentially life threatening behaviours) capturing 45.5% of the variance in aberrant driving behaviours assessed. Our reasoning for the sample size of this analysis is that the majority of previous literature achieved three to four factor solutions when conducting exploratory analysis on the DBQ (Winter & Dodou, 2010). Furthermore, studies suggest that exploratory factor analysis can be performed on a minimum of 50 cases and this study has 66 (Beavers et al., 2013).

## 4.2 Self-Report Measures of Executive Function are Associated with and Predictive of Aberrant Driving Behaviour

### 4.2.1 Discussion of Correlations

The absentminded factor from the factor analysis was shown to be strongly related to these BRIEF-A subscales: Shift, Emotional Control, Working Memory and Plan/Organise subscales. This suggests that being absentminded when driving is connected to an individual's ability to effectively switch between unrelated tasks, regulate their emotions, hold information within their working memory and plan out as well as organise actions into achievable goals. For example, item 37 of the DBQ, which loaded into the Absentminded Factor (i.e. get into the wrong lane at a roundabout or approaching a road junction), is reminiscent of the Plan/Organise subscale as a driver would need to plan which lane to get into, in order to exit the roundabout towards their desired destination. Working Memory would also be utilised to provide information about the roundabout ahead in order to plan a course of action more effectively. Further, Shift would be used to switch from continuing to converse with passengers and navigating the roundabout successfully. Lastly, Emotional Control is needed to maintain clarity of thoughts and focus on the task ahead despite conflict and heated conversation with passengers. Previous literature is in line with these findings as individuals who show more inattention when driving are known to display difficulties in EF, which is consistent with the findings of this study (Rike et al., 2015).

Similar to this, the Close Call factor also correlated with the same BRIEF-A subscales as the absentminded factor. This indicates that difficulty in these areas of EF are associated with behaviour while driving that could potentially cause a collision. For example, item 20 of the DBQ that loaded into the Close Call factor (i.e. try to overtake without first checking your mirror, and then get hooted at by the car behind which has already begun it's overtaking manoeuvre), is thought to utilise the Plan/Organise subscale as an individual who fails to check their mirrors before overtaking displays a lack of planning and organisation of their actions to effectively complete the manoeuvre. Working memory would be used to gathering and maintaining up-to-date information on the unfolding situation of the road so that the driver can make an informed decision about overtaking. Furthermore, Shift could be utilised when switching attention from the road to the mirrors to check behind for upcoming traffic. Lastly, emotional control is exercised to maintain clarity of thought and prevent emotionally salient conversation from distracting the driver. To our knowledge, there is no research that has endeavoured to investigate drivers who have almost collided with other road users and whether they suffer from executive difficulties within these areas. Thus, it is advised that future research explores this finding to clarify the relationship between these subscales and close calls in drivers.

The Risky Driving factor was only found to be related with the Organisation of Materials subscale of the BRIEF-A, which suggests that risk taking driving behaviours are associated in some form to a driver's disorganisation within their physical environment. An example of this can be found within item 29 of the DBQ that loaded into the Risky Driving factor (i.e. Park on a double-yellow line and risk a fine), this is reminiscent of an individual who is disorganised within their environment and has not thought about where to park their car without risking a fine. More interestingly is what this finding does demonstrate, which is that other executive skills are not present within risky driving behaviour. Previous research has shown that individuals who exhibit risky taking driving behaviour do display more disinhibition of their actions (Jongen et al., 2011), which is contradictory of this result as no such association was observed suggesting that risky driving is influenced by other variables more than EF.

The dangerous driving factor did show four strong correlations with Inhibit, Self-monitoring, Plan/Organise and Organisation of Materials. In addition to this, Initiate and Task-monitoring were also found to be associated when controlling for anxiety. These results suggest that individuals who exhibit dangerous driving behaviour are more likely to be disinhibited in their actions, less likely to recognise the consequence of their actions, ineffective at planning and organising their actions as well as being disorganised in their physical environment. As well as this, they are more likely to be non-compliant in following the highway code as well as failing to recognise one's own errors in order to correct them. An applicable example would be item 19 of the DBQ that loaded into the Dangerous Driving factor (i.e. angered by another driver's behaviour, you give chase with the intention of giving him/her a piece of your mind) as inhibition is needed to control the emotional reaction of giving chase, possibly putting yourself in danger as well as the individual who angered the driver. Self-monitoring is required to introspectively question your actions towards the driver that has angered the individual. Plan/organise skills would need to be utilised in order to effectively give chase following the actions of the driver in front that has angered the individual. Furthermore, poor initiating skills are demonstrated by giving chase to the driver, disregarding traffic laws and norms in order to tell off the driver who angered them. Lastly, poor task monitoring abilities are considered to reinforce this behaviour, as the successfulness or failure of the action is not registered through monitoring as effectively no aversion to this behaviour is developed and therefore repeated. These findings are in support of literature that has demonstrated low EF abilities being associated with dangerous driving and problematic driving outcomes (Hayashi, Foreman, Friedel, & Wirth, 2018b).

### 4.2.2 Discussion of Regressions

Following on from this, predictive analysis revealed that the BRIEF-A subscales alongside certain co-variates successfully predicted a large proportion of the variance (23.1%) in the absentminded factor of the DBQ. Furthermore, working memory and gender offered significantly more to the model than the rest of the variables inputted despite bootstrapping. This finding is consistent with recent distracted driving studies that show impairment in working memory capacity can improve the chances of engaging in distracted driving (Louie & Mouloua, 2019; Wood et al., 2016). In addition to this, the role gender plays in DBQ scores is consistent with earlier research (Tabibi et al., 2015).

The Close Call factor was found to not be significant on BRIEF-A subscales suggesting that EF does not significantly influence this type of driving behaviour enough to make an impact on results. Findings from previous studies is difficult to compare as the factor and the items it encompasses to our knowledge have not yet been examined. However, because of the small number of data points within this study more participants could provide a higher level of clarity to these findings.

The next regression into the Risky Driving factor of the DBQ was shown to be significant with the BRIEF-A subscales alongside covariates. This suggests that behaviour involving risk taking whilst driving is considerably influenced by an individual's executive skills. Further investigation revealed that anxiety, Self-monitoring and Organisation of Materials were the only components that offered more over other predictors in the model. This implies that these variables are more central to this type of behaviour. However, when bootstrapping was conducted these results became non-significant apart from Organisation of Materials, which advocates that disorganisation within the driver's physical environment is a key indication of risky driving behaviour. Previous research into risky driving behaviour has not to our knowledge examined the connection between disorganisation in an individual's physical environment and how they drive on the road. This finding is therefore recommended to be replicated in future research and that this result is taken with caution.

Lastly, the BRIEF-A subscales alongside covariates were found to be significant in predicting the Dangerous Driving factor of the DBQ. This suggests that individuals who are more likely to commit unlawful acts as well as be involved in more life-threatening driving behaviour are considered to have more difficulty in EF skills. Several BRIEF-A subscales (Shift, Self-monitor, Working Memory and Organisation of Materials) as well as autistic traits and anxiety were found to be predictors of this dangerous type of driving behaviour. This is consistent with previous work, which found that individuals who were engaged in more dangerous driving behaviours were more likely to show difficulty in executive skills (Hayashi et al., 2018b). However, Organisation of Materials was the only result that was consistent over 10,000 bootstrapped samples, which suggests that the subscale is a more reliable predictor of dangerous driving and to our knowledge has not been researched within literature. Contrary to this, when comparing results across experiments, Organisation of Materials was found to be negatively associated with traffic collisions within the driving simulator. This is in direct contradiction of previous literature and other findings within the present study. However, this result was calculated with a much smaller sample size of 22 and has only just passed significance in analysis ($p$ = .045), so this result may prove to be inconsequential.

Overall, results from the first part of the study suggest there is a distinctive relationship between self-reported measures of EF and aberrant driving behaviour, this has implications concerning road traffic safety and the training of late adolescent to young adult drivers, as they will need to be educated about scenarios that they may be susceptible to because of their difficulty in certain EF skills. Findings from correlational analysis are difficult to compare as only a small amount of studies have investigated the use of self-report EF measures with aberrant driver behaviour. However, a study has been conducted with the BRIEF-A and a driving self-efficacy questionnaire that was later compared with the Swedish version of the Driver Behaviour Questionnaire (Rike et al., 2015). They found that Shift, Self-monitor, Working Memory, Plan/Organise, Task-monitor and Organisation of Materials were associated with driving self-efficacy scores and correlated with two of the four factors on the Swedish DBQ. The results from this study are comparable to the current thesis' results as similar subscales were shown to be associated with DBQ factors.

## 4.3 Neuropsychological Measures of Executive Function are Associated with and Predictive of Problematic Driving Outcomes in a Driving Simulator

### 4.3.1 Discussion of Correlations

Investigation using correlational analysis between neuropsychological tests of EF and problematic driving outcomes in the driving simulator were mostly non-significant suggesting that executive difficulty is not as large an influence as predicted. The first positive correlation was found between stroop task performance and times participants went on off road excursions in the driving simulator. This suggests that larger reaction times between congruent and incongruent trails, indicating difficulty in inhibiting a prepotent response, are linked with a driver going off of the road in a simulated environment. This is consistent with previous findings, which found that individuals who are more disinhibited are more likely to brake driving norms in a simulated environment (Constantinou et al., 2011).

Similar to the first correlation, participants who broke right of way rules within the simulator displayed more disinhibition on the stroop task. Both these positive correlations are suggestive of behaviour that requires an equal amount of restraint to follow road traffic law that is being disinhibited. This finding is consistent with previous research, which found that stroop task performance is a key indicator of dangerous driving behaviour (Jackson et al., 2013).

The third positive correlation observed was between double letter cancellation task performance and the amount of pedestrian collisions participants had during their drives in the driving simulator. This relationship is not consistent with our hypothesis as participants who had good double letter cancellation score ended up having a higher frequency of pedestrian collisions. One possible explanation for this finding is that participants who have more confidence in their perceptual abilities are more likely to collide with pedestrians. Furthermore, previous studies have found that poor hazard perception can increase the likelihood of road traffic collisions may be due to it being a more naturalistic method of assessing a driver's perceptual abilities (Sagberg & Bjørnskau, 2006).

The last positive correlation observed was between double letter cancellation task performance and right of way violations. Similarly, this finding is potentially explained by overconfidence in one's own perceptual abilities that informs the individual to inhibit road traffic norms and ignore right of way. Earlier literature found that decreases in hazard perceptual skills are associated with more dangerous driving behaviour, which is not consistent with this finding (Borowsky, Shinar, & Oron-Gilad, 2010). However, the methodology of hazard perception tasks is considered more naturalistic of driving situations compared with a double letter cancellation task. Therefore, results cannot be applied to current literature, as confidence in one's abilities is a potential covariate that has not been thoroughly investigated in regard to problematic driving outcomes and neuropsychological tests of EF.

A negative correlation was discovered between trail making task performance and times participants ran red lights in analysis. This finding suggests that participants who completed the trail making task faster (i.e. good performance) than others also ran more red lights. This was not expected as surrounding literature suggests that slower times (i.e. poor performance) on the trail making task are linked with failing to stop at a traffic light (West et al., 2010). This could be potentially explained by a few possibilities, the relationship could purely be coincidental based on a weakness in the experimental design or how it was presented, creating a false positive outcome. In this instance, the use of a more robust and naturalistic trail making task could be useful in determining the strength of this correlation (Lee, Lee, & Choi, 2016). Another possibility is that the correlation is indirect and has been simplistically measured, as multiple contributory factors have been identified for why individuals do not stop at red lights (Bonneson, Brewer, & Zimmerman, 2001). For example, approach speed (e.g. driving 50mph in a 30mph zone), consequences of stopping suddenly (e.g. rear-end crash), consequences of not stopping (e.g. violating road traffic laws, impact from the side) and overconfidence (Bonneson et al., 2001) are variables which could be potentially affected by cognitive, attentional and executive processes (measured by the trail making task) which have caused this interaction to occur. To give an example of this, an individual believes that they have better cognitive faculties than average. As a result they may think that they can escape dangerous driving outcomes and therefore commit more dangerous acts and push boundaries.

### 4.3.2 Discussion of Regressions

From the correlational findings, regression analysis was conducted to control for the effect of other neuropsychological measures of EF and covariates. Findings only revealed one significant regression model that predicted 33.4% of the variance in right of way violations in the driving simulator. The model stated that after bootstrapping, stroop task performance was the only significant predictor of right of way violations in the driving simulator. These findings are consistent with literature suggesting that problems with inhibition are linked with dangerous and distracted driving (Constantinou et al., 2011).

In general, results from the second part of the study are inconclusive as correlations performed between neuropsychological tests of EF and problematic driving outcomes in the driving simulator did find four positive correlations and one negative that was significant between these variables. However, regression analysis on most accounts was non-significant even with covariates being controlled for in models. This does raise questions about the internal validity of the neuropsychological tests used and whether they require adaptation as seen in previous studies. For example, (Cox et al., 2017) conducted a driving related working memory, response inhibition and dual task study that included elements of the original neuropsychological tests within driving-like scenarios, which may prove to be a more naturalistic presentation of the assessment of EF. Alternatively, the driving simulator variables chosen may have needed longer periods of observation within the study as participants were only given approximately 10 minutes of time for each of the three drives, resulting in a lack of findings.

## 4.4 Self-report and Neuropsychological Measures Assess Different Aspects of Executive Function

Mostly consistent with what was hypothesised, self-report and neuropsychological measures of EF were not significantly related to eachother. Preceding research is in accordance with the majority of these findings, which state that neuropsychological tests of EF are not significantly related to self-report measures of EF. However, one significant association was discovered between the Organisation of Materials subscale and trail making task performance. A possible explanation for this finding, is that a link between self-report and neuropsychological tests of EF are present however, current research has only assessed a limited amount of EF measures, which has created the view that there is no connection. More than 90 neuropsychological tests have been used to assess EF, so it is unlikely that all neuropsychological tests have been examined alongside self-report measures (Packwood et al., 2011). An alternative to this explanation is that the finding emerged due to a lack of data points or potential outliers within the dataset that created a type 1 error (false positive). As the Organisation of Materials subscale and the Trail Making Task are not theoretically designed to measure any of the same aspects of EF and previous research has found no relationship between the variables, the hypothesis is still considered to be accepted despite this discrepancy.

## 4.5 Potential Co-variates Are Associated with Executive Function, Aberrant Driving Behaviour and Problematic Driving Outcomes

### 4.5.1 Anxiety

Correlational analysis investigating anxiety scores between both EF measures has found that anxiety is positively correlated with four of the BRIEF-A subscales: Inhibit, Emotional Control, Initiate and Task Monitor. This finding suggests that anxiety scores are connected to executive difficulties, which is consistent with earlier literature found within the area. When conducting similar analysis comparing neuropsychological tests of EF with anxiety scores, this was also found to be the same. This was not predicted, as preceding research did find differences within neuropsychological tests. Although, different tests were used during this investigation, which may explain why this finding is unique within literature.

Following on from this, anxiety was checked for any associations with driving measures and was found only to be related to dangerous driving behaviour in the Driver Behaviour Questionnaire (DBQ). This result is similar to existing literature, which found that anxiety was influential throughout a majority of factors in the DBQ. However, the result was only found within one factor in the current study, which suggests that factor analysis may have concentrated items closely related to anxiety within a singular factor compared to other studies.

### 4.5.2 Autistic Traits

From the results of the correlational analysis of co-variates, autistic traits were found to be correlated with seven of the possible nine BRIEF-A subscales. It is widely known within literature, individuals who are on the autistic spectrum have difficulty in certain executive skills. However, limited amounts of research have investigated the broader autism phenotype proposed by Baron-Cohen et al. (2006), and how traits of autism could be used as a predictor of EF difficulty. This result suggests that autistic traits are related to difficulty in EF skills, which is in line with previous literature that has tested this (Christ, Kanne, & Reiersen, 2010). Independent samples *t*-tests have also shown that there is a significant difference between individuals with high and low autistic traits, which provides further evidence for autistic traits being predictive of difficulty in EF. Consequently, from the first part of the study's conclusions a proportion of individuals who exhibit more aberrant driving behaviours are potentially individuals who also have high autistic traits that would also show difficulty in executive skills. However, as analysis did not provide enough evidence to directly link autistic traits to aberrant driving behaviour this relationship should be considered with caution.

### 4.5.3 Gender

When examining the correlational analysis between co-variates, gender was discovered to correlate with the absentminded factor of the DBQ. This would suggest that an individual's biological sex is connected to absentminded behaviour while driving. However, the current study did have a larger majority of individuals who identified as female (75%), which may have skewed this result in favour of a specific biological sex. Nevertheless, this finding is partially consistent with previous literature, which found that gender accounted for over 40% of the variance in overall DBQ score. Although, the current study did not find this overall, gender did make up a proportion of variance in some regression analyses. Studies within this area are sparse and have rarely been replicated so the current findings and previous literature warrant further investigation to reliably test if gender really does play this large role in driving behaviour.

### 4.5.4 Age

Age was not found to be related to many of the variables tested, this is perhaps due to the small age range of participants (18-26 years old). Even so, one result has shown to be noteworthy between the number of times participants were caught speeding in the driving simulator. This result demonstrates that even within such as small age range, individuals were observed differently between ages and breaking the speed limit by quite a substantial negative correlation ($r$ = -.452). This is consistent with literature that states that young drivers are more likely to exhibit dangerous or more risk-taking driving behaviour. However, no research to our knowledge has found differences within this small of an age range before.

In general, co-variates do show a need for future research to measure their effects on EF measures and driving variables. Also, anxiety, autistic traits, gender and age do account for a proportion of the variance within regression models, which needs to be investigated. These findings are coherent with the hypothesis stated within this thesis as well as the underlying research within the respective areas of the co-variates.

## 4.6 Overall Executive Function is a Better Predictor of Aberrant Driving Behaviour than Individual Subscales

From correlational analysis, the global executive composite (GEC) was found to be more significantly associated than the majority of BRIEF-A subscales in the Absentminded, Close Call, Risky Driving and Dangerous Driving factors of the Driver Behaviour Questionnaire (DBQ). This finding suggests that overall EF is a more consistent predictor of aberrant driving behaviour than the BRIEF-A subscales. However, previous literature that examined the use of the GEC and self-reported driving outcomes did not find this association, which mirrors the current study's findings. This has created an inconsistency within literature and implies the need for further study that can clarify a more dominant position.

The first regression with the GEC and absentminded factor, found that when bootstrapping coefficients were observed the GEC was the only variable that predicted absentminded driving behaviour. When compared with the BRIEF-A subscales regression, the GEC has shown to be a better predictor of absentminded behaviour than the equivalent Working Memory subscale. Suggesting that even though Working Memory offers significantly more predictive value than the other subscales within the regression, overall EF is better at predicting aberrant driving behaviours in participants. This provide support for the current study's hypothesis that overall executive function is a better predictor of aberrant driving behaviour.

The second regression with the GEC and the Close Call factor alongside covariates found that autistic traits and the GEC were the most significant predictors of behaviour that leads to close calls whilst driving. There was no finding to compare when looking at the BRIEF-A subscales regression, as when the subscales were inputted alongside co-variates, they did not find any significant predictors of the Close Call factor. This suggests that overall EF alongside autistic traits are better predictors of this type of aberrant driving behaviour than the BRIEF-A subscales. Providing more support for the current study's hypothesis.

The third regression with the GEC and the Risky Driving factor alongside covariates found that the GEC and anxiety scores were the most significant predictors of risky driving behaviour in participants.

When this finding was compared to the BRIEF-A subscales regression, it showed that Organisation of Materials had negligible lead in terms of effect size. However, the GEC was statistically more significant before and after bootstrapping, suggesting that the GEC is a more reliable predictor of risky driving behaviour compared to Organisation of Materials. This is consistent with other findings within the current study and supports the likelihood of the hypothesis being correct.

The last regression with the GEC and the Dangerous Driving factor alongside covariates found that after bootstrapping, anxiety scores and the GEC were the most significant predictors of dangerous driving behaviour. Similarly, when comparing these results to the BRIEF-A subscales regression, the Organisation of Materials subscale does have a higher effect size than the GEC. However, the GEC does hold a higher level of significance, which stands up to bootstrapping, implying that it is a more reliable predictor. Interestingly, anxiety scores show a higher effect size and significance as a predictor of dangerous driving within the overall EF regression compared to the BRIEF-A subscales regression. This suggests that while Organisation of Materials has a slightly larger effect size within results, the GEC alongside anxiety scores are better predictors of dangerous driving than BRIEF-A subscales. This adds to the growing support for overall EF being a better predictor of aberrant driving behaviour.

In summary, comparisons between the BRIEF-A subscales regression analyses, provides a great deal of support for the hypothesis within the current thesis. To our knowledge, only one study has examined the relationship between the BRIEF-A and self-reported driving outcomes (Rike et al., 2015). However, the GEC was not found to mirror the predictive relationship found within the current study's findings. This inconsistency indicates the need for further study to clarify the position of this predictive association. However, the measure of driving outcomes within the earlier study is not representative of aberrant driving behaviours on the DBQ. Therefore, the hypothesis that overall EF is a better predictor than components of EF is accepted within the current thesis, although further study is recommended for more resounding support of this conclusion.

## 4.7 Implications, Limitations and Future Research

The present thesis adds to the executive function (EF) and driving literature by providing preliminary evidence of significant regression models and correlations between self-report EF measures and aberrant driving behaviour. Given the limited availability of previous research on EF and driving behaviours, it is our hope that the present findings will encourage and guide future research to help promote the maintenance and rehabilitation of EF abilities involved in aberrant driving behaviour. The current study is the first, to our knowledge, to evaluate the predictive association between self-report and neuropsychological measures of EF on self-reported aberrant driving behaviours and problematic driving outcomes within a driving simulator.

The current thesis does also draw into question previous findings between neuropsychological tests of EF and problematic driving outcomes in driving simulators. As the study's findings, found only five significant correlations with mostly non-significant regression models however, this may have been the result of an insufficient sample size. The present study is considered one of the first investigations to place emphasis on the influence of co-variates such as, anxiety and autistic traits when studying EF and driving behaviour. Lastly, EF researchers have normally subscribed to a certain side in the debate of EF being either a unitary construct or a multidimensional model of components. However, this thesis attempts to measure the effectiveness of a collection of executive components compared to overall EF in predicting aberrant driving behaviours.

The generalisability of the present results is limited due to the nature of our sample. Firstly, the sample consists of undergraduate students rather than a sample selected from the general population between the ages of 18-26. Secondly, 75% of participants were female and previous research has shown that sex differences exist within driving and executive abilities. Despite biological sex being accounted for within multiple regression models, there is the potential that this may have influenced our results (Grissom & Reyes, 2019; Keay et al., 2018). Lastly, the ratio of autistic traits was skewed in favour of low autistic traited individuals rather than there being an even spread of high and low autistic traits throughout the sample. However, this is expected as participants were screened for a diagnosis of autism which would make it more likely that individuals taking part have low autistic traits. Future studies should aim for a more even representation of gender and high autistic trait individuals by using a pre-screen questionnaire where they could select a suitable ratio of individuals from these demographics.

A further limitation of the current study is the presence of multicollinearity between the BRIEF-A subscales, which could potentially mask the true predictor of the factors in the DBQ. However, this is expected as EF is an area experiencing debate in whether EF can be split into multiple components or is a singular executive system. Thus, the subscales that measure behaviour that is representative of these components should correlate strongly with each other.

From this preliminary evidence of a predictive association between EF and driving measures, it is recommended to conduct more inclusive studies involving the general public in different age ranges to provide more clarity about executive skills and how they interact with driving abilities. In addition to this, it is recommended that the executive skills and driving ability of individuals who have been reported for previous driving offenses are compared against a control group to identify areas of improvement in the rehabilitation of unlawful driving. Future work with EF should also consider the use of eye-tracking equipment to explore differences between individuals with high or low overall executive abilities and their effectiveness at avoiding hazardous driving situations. This would further provide evidence that difficulty in EF skills can impair an individual's ability to drive and should be considered during the initial training of drivers and in the rehabilitation of drivers who have committed offenses.

## 4.8 Conclusions

In this thesis, we examined the predictive association of self-report and neuropsychological measures of EF on aberrant driving behaviour and problematic driving outcomes in a driving simulator. After examining correlation and regression analysis, our results concluded that self-reported EF measures are significant predictors in self-reported aberrant driving behaviour.

Although previous findings indicated that neuropsychological measures of EF would be correlated with and predictive of problematic driving outcomes in the driving simulator, our findings are not representative of this. The measures of EF used in this thesis do not significantly relate to eachother as predicted, which is in accordance with previous research stating that self-report and neuropsychological tests measure different aspects of EF. Furthermore, the co-variates of gender, autistic traits and anxiety were found to significantly account for a proportion of the variance in regression models. This shows that it is important to include these measures in future research as neglecting these variables can produce type one errors (false positive). Overall executive score was a better predictor of self-reported driving behaviour than components of EF, this suggests that general executive function abilities are a better measure to identify differences between populations compared to individual components of EF. Participants were skewed more towards being female and having low autistic traits, to improve upon this, a more diverse sample size could have been recruited with a large initial screening questionnaire. Future researchers should consider investigating EF skills between individuals who have motoring offenses compared to controls. Also, high and low executive skills in individuals should be compared with response and effectiveness of driving in a hazardous situation. Regardless, our results point to the need for driving safety officials to consider the affect executive functioning has on driving behaviours.

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# Appendix

## 6.1 Materials

### 6.1.1 Information Sheet (Qualtrics)

**Information sheet (for Part 1 embedded in Qualtrics questionnaire):**

Q1 Thank you for your interest in our study. Our aim of this study is to assess some of the cognitive skills involved in driving and identify if anxiety and autistic traits are influencing factors in these cognitive skills and driving. The study will be under the supervision of Dr Lesley Allinson and Dr Niko Kargas, School of Psychology, University of Lincoln. Working alongside Callum Reynish (postgraduate student)

This is the first of a two-part study. Here we aim to measure your everyday driving behaviours, cognitive skills, autistic traits and lastly anxiety. Also, we will ask you to complete some information about yourself and your driving experiences.

We will ask for your name and contact details as we may need to contact later in order to invite you back for the second part of the study. This information will be stored separately from the dataset as it will be only used for the purpose to contact you and link your data. hopefully arrange a time for you to visit the University to undertake the second part of the study to complete our driving experiment.

There will be no individual feedback on the completed questionnaires or driving simulator tasks. The driving tasks are not meant to judge driving ability but simply to help understand and to hopefully improve these abilities.

We expect this online study to take less than 30 minutes overall. If there are any questions that you do not wish to answer, then please omit them and move to the next question. At any time you can withdraw from the study by closing the browser on your computer. After completion of the study, if you change your mind about allowing us the use your data, you can contact us within two weeks, and we will remove your data.

The study has the approval of the School of Psychology Ethics Committee, and in accordance with the British Psychological Society's ethical Guidelines. The study is under the supervision of Dr Lesley Allinson, School of Psychology, University of Lincoln. If you feel you need more information, then please email lallinson@lincoln.ac.uk so we can assist you before you complete this online questionnaire.

### 6.1.2 Consent Form (Qualtrics)

**Consent Form (Part 1) – embedded in Qualtrics**

**Before you start the questionnaire please read the following statements carefully:**

- I have been informed about the study and had an opportunity to ask questions
- My participation is voluntary and that I can withdraw at any time by closing the browser or I can remove my results anytime up to two weeks after completing the questionnaire by contacting the researcher. No reasons will be required.
- My name and contact details will be recorded so I can take part in the driving study later
- My details will be held confidentially (only assessed by the researchers) and stored securely on password protected computers, for a period of seven years. At no time will I be identified in any possible reports or publications that might result from this study. Should I later wish to withdraw my answers from the study I can do so by contacting the researcher. Dr Lesley Allinson (lallinson@lincoln.ac.uk) and my data will be removed.
- This is only one part of the study. I understand however that this too is voluntary and that my consent will again be required at that time.
- There will be no individual feedback on the completed questionnaires or driving simulator tasks. The driving tasks, though they represent activities present in ‘real’ driving, do not assess driving skills.

**If you agree to the above then If please select the ‘Yes’ button to continue**

### 6.1.3 Debrief (Qualtrics)

We hope you are still happy to let us use your questionnaire answers to help us explore this topic. If however you change your mind, please just drop us an email (lallinson@lincoln.ac.uk) and we will withdraw your data without further question. Please do this within 2 weeks of this date.

If you have any ethical concerns about the study, then please contact the School of Psychology Research Committee (SOPREC) – email: SOPREC@lincoln.ac.uk.

Once again, many thanks for taking part in this research. I hope you found the questions straight forward and not a problem in any way.

If however you have concerns following the questionnaire, and are a student at the university of Lincoln, please contact student wellbeing at:

Alternatively (students and non-students), can contact the National Autistic Society (www.autim.org.uk) or call their Autism Helpline that provides confidential expert advice and support on autism for autistic people, their families and friends.

**Telephone: 0808 800 4104**
**Helpline opening hours: Monday-Thursday 0am-4pm, Friday 10am-3pm (excluding Bank holidays)**

We look forward to seeing you for the second and final part of the study. We hope that you enjoyed the driving games.

| | |
|---|---|
| Dr Lesley Allinson | (Senior Lecturer in Psychology) |
| Callum Reynish | (Postgraduate student) |
| Dr Niko Kargas | (Senior Lecturer in Psychology) |

### 6.1.4 Demographic Questions (Qualtrics)

Please enter your full name

Please enter an email address that we can contact you on

Please enter your age (participants need to be between 18 and 25)

I identify my gender as:

- Female
- Male
- Trans
- Gender Variant/Non-conforming
- Not Listed:
- Prefer not to say

Do you have a diagnosis of Autism Spectrum Disorder?

- yes
- No

Do you have any condition that you think might affect your ability to drive? If so, please mention this below

Do you hold a full driving license?

- Yes
- No

Do you have your own car?

- Yes
- No

How many years of driving experience have you had?

- less than a year
- between 1 and 2 years
- between 2 and 3 years
- between 3 and 4 years
- between 4 and 5 years
- more than 5 years

How often do you drive?

- most days
- most weeks
- most months

- very infrequently
- never

Do you feel safe when you drive?

- Yes, very safe
- I mostly feel save when driving
- I sometimes feel unsafe when driving
- Most of the time I feel unsafe when driving
- I never drive

Have you ever had an accident whilst driving?

- Yes
- No

### 6.1.5 Information Sheet (Lab)

## Information sheet for the driving performance task

During this session, you will be asked to complete a series of tasks. Some on paper, some online and others operating a driving simulator with a driving seat and steering wheel. The tasks on paper and online seek to gather data on cognitive functions, anxiety, autistic traits and driving behaviour. These tests will be done before the first time getting into the simulator and after last time driving in the simulator.

There will be:

A) A familiarisation session to get you used to the driving simulator – to steering and speed management (10 mins)

B) Four neuropsychological tasks which you will need to complete (30 mins):
   a. Digit Span task
   b. Trail Making Task
   c. Double Letter Cancellation Task
   d. Stroop Task

C) Three different driving sessions in the old and modern districts of a city and on the motorway (60 mins)

The drive may be challenging but this is to replicate the scenarios which are common in real life scenarios but more frequently. There will be no individual feedback on the driving simulator tasks, to not discourage any participants from driving if they performed poorly.

Though the session will last around 60 minutes we expect to take breaks during it, but we do encourage the use of a break within intervals between the above tasks. Further instructions will be given at the start of each task.

The study has the approval of the School of Psychology Ethics Committee, and in accordance with the British Psychological Society's ethical Guidelines.

The study is under the supervision of Dr Lesley Allinson and Dr Niko Kargas, School of Psychology, University of Lincoln. If you feel you need more information, then please ask the researcher who will be happy to answer your questions.

| | |
|---|---|
| Dr Lesley Allinson | (Senior Lecturer in Psychology) |
| Callum Reynish | (Postgraduate research student) |
| Dr Niko Kargas | (Senior Lecturer in Psychology) |

### 6.1.6 Consent Form (Lab)

**Consent form for the driving simulator task**

- I understand what to expect in this study and have been given opportunity to seek further clarification

- I understand that my participation in this research is voluntary and that I can withdraw at any point, or request a break

- I understand that my name and contact details will be recorded to enable the data from this driving study to be linked to the data from my previous online questionnaire.
- I understand that my details will be held confidentially (only assessed by the researchers) and stored securely on password protected computers separate from the data itself, for a period of seven years. At no time will I be identified in any possible reports or publications that might result from this study.

- I understand that should I later wish to withdraw my data from the study I can do so by contacting (the researcher) and my data will be removed without further explanation. I should do this within the next two weeks.

- I understand that here will be no individual feedback on the completed driving simulator tasks. The driving tasks, though they represent activities present in ‘real’ driving, do not assess your driving skills in ‘real’ circumstances.

Do you consent to take part in the study? If so, please fill in your name below and sign

Participant Name……………………………… Participant signature……………………………………

Researcher's Name………………………….. Researcher's signature…………………………………

### 6.1.7 Debrief (Lab)

**Debrief for the driving simulator task**

Thank you very much for completing this study. The questions asked within the first part of the study were intended to measure driving behaviour, autistic traits, anxiety, and several cognitive functions (e.g. Inhibition, Task Switching and Working Memory). We expect to find predictive relationships between some of these cognitive functions and driving behaviours and outcomes.

In the second part of the study we have measured the some of the same cognitive skills in a more practical way using computer assessment and paper tasks. We then assessed driving performance (i.e. measured by violation of road traffic rules) in a variety of different driving environments. Following pre-planned designated route encountering various driving challenges to safely respond to and abiding by safe road conduct.

Earlier research has shown that these cognitive skills are essential in being able to operate a motor vehicle however, there is still a lot we do not know about these skills how they influence driving. We hope to find that certain cognitive skills need to be focused on for specific driving behaviour. For example, disinhibition about road traffic laws could make them more likely to end up in a road traffic collision.

We hope you are still happy to let us use your driving simulator data. If, however you change your mind, please just drop us an email (CReynish@lincoln.ac.uk) and we will withdraw your data without further question. Please do this within 2 weeks of this date.

If you have any ethical concerns about the study, then please contact the School of Psychology Research Committee (SOPREC) – email: SOPREC@lincoln.ac.uk.

We do not envisage that there are any negative effects of taking part in our study, either the questionnaire or the driving tasks. If however, you are worried by any aspect, please contact Student wellbeing (01522 886400) if you are a student of the University, or alternatively (students and non-students), can contact the National Autistic Society (www.autim.org.uk) or call their Autism Helpline that provides confidential expert advice and support on autism for autistic individuals, their families and friends.

**Telephone: 0808 800 4104**
**Helpline opening hours: Monday-Thursday 0am-4pm, Friday 10am-3pm (excluding Bank holidays)**

Once again, many thanks for taking part in this study

| | |
|---|---|
| Dr Lesley Allinson | (Senior Lecturer in Psychology) |
| Callum Reynish | (MSc by Research student) |
| Dr Niko Kargas | (Senior Lecturer in Psychology) |

#### 6.1.8 AQ-10

National Institute for Health Research

# AQ-10

## Autism Spectrum Quotient (AQ)

*A quick referral guide for adults with suspected autism who do not have a learning disability.*

| | *Please tick one option per question only:* | Definitely Agree | Slightly Agree | Slightly Disagree | Definitely Disagree |
|---|---|---|---|---|---|
| 1 | I often notice small sounds when others do not | | | | |
| 2 | I usually concentrate more on the whole picture, rather than the small details | | | | |
| 3 | I find it easy to do more than one thing at once | | | | |
| 4 | If there is an interruption, I can switch back to what I was doing very quickly | | | | |
| 5 | I find it easy to 'read between the lines' when someone is talking to me | | | | |
| 6 | I know how to tell if someone listening to me is getting bored | | | | |
| 7 | When I'm reading a story I find it difficult to work out the characters' intentions | | | | |
| 8 | I like to collect information about categories of things (e.g. types of car, types of bird, types of train, types of plant etc) | | | | |
| 9 | I find it easy to work out what someone is thinking or feeling just by looking at their face | | | | |
| 10 | I find it difficult to work out people's intentions | | | | |

**SCORING:** Only 1 point can be scored for each question. *Score 1 point for Definitely or Slightly Agree on each of items 1, 7, 8, and 10. Score 1 point for Definitely or Slightly Disagree on each of items 2, 3, 4, 5, 6, and 9.* If the individual scores **more than 6 out of 10**, consider referring them for a specialist diagnostic assessment.

This test is recommended in 'Autism: recognition, referral, diagnosis and management of adults on the autism spectrum' (NICE clinical guideline CG142). www.nice.org.uk/CG142

**Key reference:** Allison C, Auyeung B, and Baron-Cohen S, (2012) *Journal of the American Academy of Child and Adolescent Psychiatry* 51(2):202-12.

UNIVERSITY OF CAMBRIDGE

autism research centre

### 6.1.9 STAI-6

## Spielberger State-Trait Anxiety Inventory (STAI: Y-6 item)

**Published:**

Marteau TM and Bekker H. The development of a six-item short-form of the state scale of the Spielberger State-Trait Anxiety Inventory (STAI). *British Journal of Clinical Psychology*. 1992;**31**:301-306.

**Measure:**

*Name* .................................................................................. *Date* ...............

*A number of statements which people have used to describe themselves are given below. Read each statement and then circle the most appropriate number to the right of the statement to indicate how you* ***feel right now, at this moment****. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.*

| | Not at all | Somewhat | Moderately | Very much |
|---|---|---|---|---|
| **1. I feel calm** ................................ | 1 | 2 | 3 | 4 |
| **2. I am tense** ................................ | 1 | 2 | 3 | 4 |
| **3. I feel upset** ................................ | 1 | 2 | 3 | 4 |
| **4. I am relaxed** ................................ | 1 | 2 | 3 | 4 |
| **5. I feel content** ................................ | 1 | 2 | 3 | 4 |
| **6. I am worried** ................................ | 1 | 2 | 3 | 4 |

**Calculation:**

To calculate the total STAI score (range 20 - 80):

- reverse scoring of the positive items (calm, relaxed, content) so 1=4, 2=3, 3=2 and 4=1;
- sum all six scores;
- multiply total score by 20/6;
- refer to Spielberger's manuals to interpret scores (a 'normal' score is approx. 34 - 36) or Bekker HL, Legare F, Stacey D, O'Connor A, Lemyre L. *Is anxiety an appropriate measure of decision aid effectiveness: a systematic review?* Patient Education and Counselling. 2003; 50: 255-262.

### 6.1.10 BRIEF-A

For each statement (1-75) below, please select one of the options - 'Never', 'Sometimes' or 'Often' to the question: ***Over the past month, have you experienced any of the behaviours outlined below? Please read each question carefully***.

| | Never (1) | Sometimes (2) | Often (3) |
|---|---|---|---|
| 1. I have angry outbursts. (1) | ○ | ○ | ○ |
| 2. I make careless errors when completing tasks. (2) | ○ | ○ | ○ |
| 3. I am disorganised. (3) | ○ | ○ | ○ |
| 4. I have trouble concentrating on tasks (such as chores, reading or work). (4) | ○ | ○ | ○ |
| 5. I tap my fingers or bounce my legs. (5) | ○ | ○ | ○ |
| 6. I need to be reminded to begin a task even when I am willing. (6) | ○ | ○ | ○ |
| 7. I have a messy wardrobe. (7) | ○ | ○ | ○ |
| 8. I have trouble changing from one activity or task to another. (8) | ○ | ○ | ○ |
| 9. I get overwhelmed by large tasks. (9) | ○ | ○ | ○ |
| 10. I forget my name. (10) | ○ | ○ | ○ |
| 11. I have trouble with jobs or tasks that have more than one step. (11) | ○ | ○ | ○ |
| 12. I overreact emotionally. (12) | ○ | ○ | ○ |
| 13. I don't notice when I cause others to feel bad or get mad until it is too late. (13) | ○ | ○ | ○ |
| 14. I have trouble getting ready for the day. (14) | ○ | ○ | ○ |
| 15. I have trouble prioritising activities. (15) | ○ | ○ | ○ |
| 16. I have trouble sitting still. (16) | ○ | ○ | ○ |

17. I forget what I am doing in the middle of things. (17)

18. I don't check my work for mistakes. (18)

19. I have emotional outbursts for little reason. (19)

20. I lie around the house a lot. (20)

21. I start tasks (such as cooking, projects) without the right materials. (21)

22. I have trouble accepting different ways to solve problems with work, friends or tasks. (22)

23. I talk at the wrong time. (23)

24. I misjudge how difficult or easy tasks will be. (24)

25. I have problems getting started on my own. (25)

26. I have trouble staying on the same topic when talking. (26)

27. I get tired. (27)

28. I react more emotionally to situations than my friends. (28)

29. I have problems waiting my turn. (29)

30. People say that I am disorganised. (30)

31. I lose things (such as keys, money, wallet, homework etc). (31)

32. I have trouble thinking of a different way to solve a problem when stuck. (32)

33. I overreact to small problems. (33)

34. I don't plan ahead for future activities. (34)

| | | | |
|---|---|---|---|
| 35. I have a short attention span. (35) | ○ | ○ | ○ |
| 36. I make inappropriate sexual comments. (36) | ○ | ○ | ○ |
| 37. When people seem upset with me, I don't understand why. (37) | ○ | ○ | ○ |
| 38. I have trouble counting to three. (38) | ○ | ○ | ○ |
| 39. I have unrealistic goals. (39) | ○ | ○ | ○ |
| 40. I leave the bathroom a mess. (40) | ○ | ○ | ○ |
| 41. I make careless mistakes. (41) | ○ | ○ | ○ |
| 42. I get emotionally upset easily. (42) | ○ | ○ | ○ |
| 43. I make decisions that get me into trouble (legally, financially, socially). (43) | ○ | ○ | ○ |
| 44. I am bothered by having to deal with changes. (44) | ○ | ○ | ○ |
| 45. I have difficulty getting excited about things. (45) | ○ | ○ | ○ |
| 46. I forget instructions easily. (46) | ○ | ○ | ○ |
| 47. I have good ideas but cannot get them on paper. (47) | ○ | ○ | ○ |
| 48. I make mistakes. (48) | ○ | ○ | ○ |
| 49. I have trouble getting started on tasks. (49) | ○ | ○ | ○ |
| 50. I say things without thinking. (50) | ○ | ○ | ○ |
| 51. My anger is intense but ends quickly. (51) | ○ | ○ | ○ |
| 52. I have trouble finishing tasks (such as chores, work). (52) | ○ | ○ | ○ |

53. I start things at the last minute (such as assignments, chores, tasks). (53)

54. I have difficulty finishing a task on my own. (54)

55. People say I am easily distracted. (55)

56. I have trouble remembering things, even for a few minutes (such as directions, phone numbers). (56)

57. People say I am too emotional. (57)

58. I rush through things. (58)

59. I get annoyed. (59)

60. I leave my room or home a mess. (60)

61. I get disturbed by unexpected changes in my daily routine. (61)

62. I have trouble coming up with ideas for what to do with my free time. (62)

63. I don't plan ahead for tasks. (63)

64. People say I don't think before acting. (64)

65. I have trouble finding things in my room, wardrobe or desk. (65)

66. I have problems organising activities. (66)

67. After having a problem, I don't get over it easily. (67)

68. I have trouble doing more than one thing at a time. (68)

69. My mood changes frequently. (69)

70. I don't think about consequences before doing something. (70)

| | | | |
|---|---|---|---|
| 71. I have trouble organising work. (71) | | | |
| 72. I get upset quickly or easily over little things. (72) | | | |
| 73. I am impulsive. (73) | | | |
| 74. I don't pick up after myself. (74) | | | |
| 75. I have problems completing my work. (75) | | | |

### 6.1.11 DBQ

No one is perfect. Even the best drivers make errors or commit violations at some time or another. many of these are trivial, but others are potentially more dangerous. This questionnaire is concerned with assessing drivers' perceptions of their own ' bad behaviours'.

The questionnaire is very simple it lists a number of errors and violations that people have experienced or observed while driving. for each item, you are required to indicate how often, if at all, this kind of thing has happened to you - say, over a period of the last year.

You do this by clicking **ONE** of the statements to the right of each item:

These statements range from **Never, Hardly ever, Occasionally, Quite often, Frequently, Nearly all the time**.

It is of course, impossible for you to give precise answers: we are only interested in your general impressions. So do not spend too long thinking about each item. Simply give your best guess as quickly as possible by clicking the statement you think is most appropriate.

| | Never | Hardly ever | Occasionally | Quite often | Frequently | Nearly all the time |
|---|---|---|---|---|---|---|
| 1. Attempt to drive away from traffic lights in third gear | | | | | | |

| | Never | Hardly ever | Occasionally | Quite often | Frequently | Nearly all the time |
|---|---|---|---|---|---|---|
| 2. Check your speedometer and discover that you are unknowingly travelling faster that the legal limit | ○ | ○ | ○ | ○ | ○ | ○ |
| 3. Lock yourself out of your car with the keys still inside | ○ | ○ | ○ | ○ | ○ | ○ |
| 4. Become impatient with a slow driver in the outer lane and over take on the inside | ○ | ○ | ○ | ○ | ○ | ○ |
| 5. Drive as fast along country roads at night on dipped lights as on full beam | ○ | ○ | ○ | ○ | ○ | ○ |
| 6. Attempt to drive away without first having switched on the ignition | ○ | ○ | ○ | ○ | ○ | ○ |
| 7. Drive especially close or "flash" the car in front as a signal for that driver to go faster or get out of your way | ○ | ○ | ○ | ○ | ○ | ○ |
| 8. Forget where you left your car in a multi-level car park | ○ | ○ | ○ | ○ | ○ | ○ |
| 9. Distracted or preoccupied, realise belatedly that the vehicle ahead has slowed, and have to slam on the brakes to avoid a collision | ○ | ○ | ○ | ○ | ○ | ○ |
| 10. Intend to switch on the windscreen wipers, but switch off the lights instead, or vice versa | ○ | ○ | ○ | ○ | ○ | ○ |

| | Never | Hardly ever | Occasionally | Quite often | Frequently | Nearly all the time |
|---|---|---|---|---|---|---|
| 11. Turn left on to a main road into the path of an oncoming vehicle that you hadn't seen, or whose speed you had misjudged | ◌ | ◌ | ◌ | ◌ | ◌ | ◌ |
| 12. Misjudge your gap in a car park and nearly (or actually) hit adjoining vehicle | ◌ | ◌ | ◌ | ◌ | ◌ | ◌ |
| 13. "Wake up" to realise that you have no clear recollection of the road along which you have just travelled | ◌ | ◌ | ◌ | ◌ | ◌ | ◌ |
| 14. Miss your exit on a motorway and have to make a lengthy detour | ◌ | ◌ | ◌ | ◌ | ◌ | ◌ |
| 15. Forget which gear you are currently in and have to check with your hand | ◌ | ◌ | ◌ | ◌ | ◌ | ◌ |
| 16. Stuck behind a slow-moving vehicle on a two-lane highway, you are driven by frustration to try to overtake in risky circumstances | ◌ | ◌ | ◌ | ◌ | ◌ | ◌ |
| 17. Intending to drive to destination A, you "wake up" to find yourself en route to B, where the latter is the more usual journey | ◌ | ◌ | ◌ | ◌ | ◌ | ◌ |
| 18. Take a chance and cross on lights that have turned red | ◌ | ◌ | ◌ | ◌ | ◌ | ◌ |
| 19. Angered by another driver's behaviour, you give chase with the intention of giving him/her a piece of your mind | ◌ | ◌ | ◌ | ◌ | ◌ | ◌ |

| | Never | Hardly ever | Occasionally | Quite often | Frequently | Nearly all the time |
|---|---|---|---|---|---|---|
| 20. Try to overtake without first checking your mirror, and then get hooted at by the car behind which has already begun it's overtaking manoeuvre | ○ | ○ | ○ | ○ | ○ | ○ |
| 21. Deliberately disregard the speed limits late at night or very early in the morning | ○ | ○ | ○ | ○ | ○ | ○ |
| 22. Forget when your road tax/insurance expires and discover that you are driving illegally | ○ | ○ | ○ | ○ | ○ | ○ |
| 23. Lost in thought, you forget that your lights are on full beam until "flashed" by other motorists | ○ | ○ | ○ | ○ | ○ | ○ |
| 24. On turning left, nearly hit a cyclist who has come up on your inside | ○ | ○ | ○ | ○ | ○ | ○ |
| 25. In a queue of vehicles turning left on to a main road, pay such close attention to the traffic approaching from the right that you nearly hit the car in front | ○ | ○ | ○ | ○ | ○ | ○ |
| 26. Drive back from a party, restaurant, or pub, even though you realise that you may be over the legal blood-alcohol limit | ○ | ○ | ○ | ○ | ○ | ○ |
| 27. Have an aversion to a particular class of road user, and indicate your hostility by whatever means you can | ○ | ○ | ○ | ○ | ○ | ○ |

| | Never | Hardly ever | Occasionally | Quite often | Frequently | Nearly all the time |
|---|---|---|---|---|---|---|
| 28. Lost in thought or distracted, you fail to notice someone waiting at a zebra crossing, or a pelican crossing light that has just turned red | ○ | ○ | ○ | ○ | ○ | ○ |
| 29. Park on a double-yellow line and risk a fine | ○ | ○ | ○ | ○ | ○ | ○ |
| 30. Misjudge speed of oncoming vehicle when overtaking | ○ | ○ | ○ | ○ | ○ | ○ |
| 31. Hit something when reversing that you had not previously seen | ○ | ○ | ○ | ○ | ○ | ○ |
| 32. Fail to notice someone stepping out from behind a bus or parked vehicle until it is nearly too late | ○ | ○ | ○ | ○ | ○ | ○ |
| 33. Plan your route badly, so that you meet traffic congestion you could have avoided | ○ | ○ | ○ | ○ | ○ | ○ |
| 34. Overtake a single line of stationary or slow-moving vehicles, only to discover that they were queuing to get through a one-lane gap or roadwork lights | ○ | ○ | ○ | ○ | ○ | ○ |
| 35. Overtake a slow-moving vehicle on the inside lane or hard shoulder of a motorway | ○ | ○ | ○ | ○ | ○ | ○ |
| 36. Cut the corner on a right-hand turn and have to swerve violently to avoid an oncoming vehicle | ○ | ○ | ○ | ○ | ○ | ○ |

| | Never | Hardly ever | Occasionally | Quite often | Frequently | Nearly all the time |
|---|---|---|---|---|---|---|
| 37. Get into the wrong lane at a roundabout or approaching a road junction | | | | | | |
| 38. Fail to read the signs correctly, and exit from a roundabout on the wrong road | | | | | | |
| 39. Fail to give way when a bus is signalling its intention to pull out | | | | | | |
| 40. Ignore "give way" signs, and narrowly avoid colliding with traffic having right of way | | | | | | |
| 41. Fail to check your mirror before pulling out, changing lanes, turning, etc | | | | | | |
| 42. Attempt to overtake a vehicle that you hadn't noticed was signalling its intention to turn right | | | | | | |
| 43. Deliberately drive the wrong way down a deserted one-way street | | | | | | |
| 44. Disregard red lights when driving late at night along empty roads | | | | | | |
| 45. Drive with only "half-an-eye" on the road while looking at a map, changing a cassette or radio channel, etc | | | | | | |
| 46. Fail to notice pedestrians crossing when turning into a side-street from a main road | | | | | | |

| | Never | Hardly ever | Occasionally | Quite often | Frequently | Nearly all the time |
|---|---|---|---|---|---|---|
| 47. Get involved in unofficial "races" with other drivers | ○ | ○ | ○ | ○ | ○ | ○ |
| 48. "Race" oncoming vehicles for a one-car gap on a narrow or obstructed road | ○ | ○ | ○ | ○ | ○ | ○ |
| 49. Brake too quickly on a slippery road and/or steer the wrong way in a skid | ○ | ○ | ○ | ○ | ○ | ○ |
| 50. Misjudge your crossing interval when turning right and narrowly miss collision | ○ | ○ | ○ | ○ | ○ | ○ |

### 6.1.12 Digit Span Task

# THE DIGIT MEMORY TEST

An assessment procedure for specialist teachers to investigate verbal memory difficulties in children's learning. Both parts are administered.

**Digits forwards**

**Start** Item A

**Finish** Failure on both trials of a pair.

**Directions** "Listen carefully as I say some numbers. When I finish, you say them."

**Delivery** Digits should be given at the rate of one per second. Administer both trials of each item. Recite digits in an even monotone without any variation in pitch of voice.

**Scoring** The individual's score is the total number of items correctly repeated forwards.

**WORKED EXAMPLE**

| Item | First Trial | or X | Second Trial | or X |
|---|---|---|---|---|
| A | 43 | | 16 | B |
| 792 | | 847 | C | 5941 |
| X | 7253 | 0 | | |
| D | 93872 | X | 75396 | X |

In this example, the total correct is 5.

**Digits Backwards**

**Directions** Administer as above but say, "Repeat these numbers after me but this time I want you to say them backwards." Give two practice trials of two digits first – any two numbers. If the child gets them wrong - correct her or him. If the child repeats the digits forwards, give a reminder that they should be reversed.

**Score** As for digits forwards.

**Final score** Total number managed (ticks) backwards and forwards added *together*. Consult Table 1 for standard score. This can also be expressed as a percentile equivalent: consult Table 2.

**Comparison** Most people can remember two more digits forwards than they can backwards. If the gap is larger than three, or smaller than one, this may be worthy of note.

**DIGITS FORWARDS**

| Item | First trial | or X | Second trial | or X | Total |
|---|---|---|---|---|---|
| A | 43 | | 16 | | |
| B | 792 | | 847 | | |
| C | 5941 | | 7253 | | |
| D | 93872 | | 75396 | | |
| E | 152649 | | 216748 | | |
| F | 3745261 | | 4925316 | | |
| G | 82973546 | | 69174253 | | |
| H | 246937185 | | 371625948 | | |
| | | | | Forwards score: | |

**DIGITS BACKWARDS**

| Item | Trial one | or X | Trial two | or X | Total |
|---|---|---|---|---|---|
| A | 83 | | 29 | | |
| B | 475 | | 615 | | |
| C | 2619 | | 3852 | | |
| D | 28736 | | 59413 | | |
| E | 624719 | | 276391 | | |
| F | 4183627 | | 1586937 | | |
| G | 52624197 | | 94617385 | | |
| | | | | Backwards score: | |

**FINAL SCORE:**

| | |
|---|---|
| Total forwards and backwards: | |
| Standard score: | |
| Percentile equivalent: | |

TABLE 1

Table 1: Estimated standard scores for digit memory performances from six years to adult

| Age | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | Adult |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Raw score 4 | 74 | 57 | 60 | 56 | 54 | 55 | 50 | 48 | 52 | 52 | 51 | 50 |
| 5 | 79 | 63 | 65 | 61 | 59 | 59 | 55 | 53 | 56 | 56 | 55 | 54 |
| 6 | 85 | 69 | 70 | 66 | 64 | 64 | 59 | 57 | 60 | 60 | 59 | 57 |
| 7 | 90 | 75 | 75 | 71 | 69 | 68 | 64 | 61 | 64 | 64 | 63 | 61 |
| 8 | 96 | 81 | 80 | 76 | 74 | 73 | 68 | 66 | 68 | 68 | 66 | 64 |
| 9 | 101 | 87 | 85 | 81 | 79 | 77 | 73 | 70 | 72 | 72 | 70 | 68 |
| 10 | 106 | 93 | 90 | 86 | 85 | 82 | 77 | 74 | 76 | 75 | 74 | 71 |
| 11 | 112 | 99 | 95 | 91 | 90 | 86 | 81 | 78 | 80 | 79 | 78 | 75 |
| 12 | 117 | 105 | 100 | 96 | 95 | 91 | 86 | 83 | 84 | 83 | 82 | 79 |
| 13 | 123 | 111 | 105 | 101 | 100 | 95 | 90 | 87 | 88 | 87 | 86 | 82 |
| 14 | 128 | 117 | 110 | 106 | 105 | 100 | 95 | 91 | 92 | 91 | 89 | 86 |
| 15 | 134 | 123 | 115 | 111 | 110 | 105 | 99 | 96 | 96 | 95 | 93 | 89 |
| 16 | 139 | 129 | 120 | 116 | 115 | 109 | 104 | 100 | 100 | 98 | 97 | 93 |
| 17 | 144 | 135 | 125 | 121 | 121 | 114 | 108 | 104 | 104 | 102 | 101 | 96 |
| 18 | 150 | 141 | 130 | 126 | 126 | 118 | 112 | 109 | 108 | 106 | 105 | 100 |
| 19 | 155 | 147 | 135 | 131 | 131 | 123 | 117 | 113 | 112 | 110 | 108 | 104 |
| 20 | 161 | 153 | 140 | 136 | 136 | 127 | 121 | 117 | 116 | 114 | 112 | 107 |
| 21 | | | 145 | 141 | 141 | 132 | 126 | 122 | 120 | 118 | 116 | 111 |
| 22 | | | 150 | 146 | 146 | 136 | 130 | 126 | 124 | 121 | 120 | 114 |
| 23 | | | 155 | 151 | 152 | 141 | 134 | 130 | 128 | 125 | 124 | 118 |
| 24 | | | 159 | 156 | 157 | 145 | 139 | 134 | 132 | 129 | 127 | 121 |
| 25 | | | | | | 150 | 143 | 139 | 136 | 133 | 131 | 125 |
| 26 | | | | | | 154 | 148 | 143 | 140 | 137 | 135 | 129 |
| 27 | | | | | | 159 | 152 | 147 | 144 | 141 | 139 | 132 |
| 28 | | | | | | 163 | 157 | 152 | 148 | 144 | 143 | 136 |
| 29 | | | | | | | | 156 | 152 | 148 | 147 | 139 |
| 30 | | | | | | | | 160 | 156 | 152 | 150 | 143 |
| 31 | | | | | | | | | 160 | 156 | 154 | 146 |
| 32 | | | | | | | | | 164 | 160 | 158 | 150 |
| 33 | | | | | | | | | | | | 154 |
| 34 | | | | | | | | | | | | 157 |
| 35 | | | | | | | | | | | | 161 |
| 36 | | | | | | | | | | | | 164 |

**TABLE 2**

| Standard score | %ile equiv | Standard score | %ile equiv | Standard score | %ile equiv | Standard score | %ile equiv |
|---|---|---|---|---|---|---|---|
| 54 | 0.1 | 77 | 6 | 100 | 50 | 123 | 94 |
| 55 | 0.1 | 78 | 7 | 101 | 53 | 124 | 95 |
| 56 | 0.2 | 79 | 8 | 102 | 55 | 125 | 95 |
| 57 | 0.2 | 80 | 9 | 103 | 58 | 126 | 96 |
| 58 | 0.3 | 81 | 10 | 104 | 61 | 127 | 96 |
| 59 | 0.3 | 82 | 12 | 105 | 63 | 128 | 97 |
| 60 | 0.4 | 83 | 13 | 106 | 66 | 129 | 97 |
| 61 | 0.5 | 84 | 14 | 107 | 68 | 130 | 98 |
| 62 | 0.6 | 85 | 16 | 108 | 70 | 131 | 98 |
| 63 | 0.7 | 86 | 18 | 109 | 73 | 132 | 98 |
| 64 | 0.8 | 87 | 19 | 110 | 75 | 133 | 99 |
| 65 | 1 | 88 | 21 | 111 | 77 | 134 | 99 |
| 66 | 1 | 89 | 23 | 112 | 79 | 135 | 99 |
| 67 | 1 | 90 | 25 | 113 | 81 | 136 | 99.2 |
| 68 | 2 | 91 | 27 | 114 | 82 | 137 | 99.3 |
| 69 | 2 | 92 | 30 | 115 | 84 | 138 | 99.4 |
| 70 | 2 | 93 | 32 | 116 | 86 | 139 | 99.5 |
| 71 | 3 | 94 | 34 | 117 | 87 | 140 | 99.6 |
| 72 | 3 | 95 | 37 | 118 | 88 | 141 | 99.7 |
| 73 | 4 | 96 | 39 | 119 | 90 | 142 | 99.7 |
| 74 | 4 | 97 | 42 | 120 | 91 | 143 | 99.8 |
| 75 | 5 | 98 | 45 | 121 | 92 | 144 | 99.8 |
| 76 | 5 | 99 | 47 | 122 | 93 | 145 | 99.9 |

### 6.1.13 Trail Making Test

# Trail Making Test (TMT) Parts A & B

***Instructions:***

Both parts of the Trail Making Test consist of 25 circles distributed over a sheet of paper. In Part A, the circles are numbered 1 – 25, and the patient should draw lines to connect the numbers in ascending order. In Part B, the circles include both numbers (1 – 13) and letters (A – L); as in Part A, the patient draws lines to connect the circles in an ascending pattern, but with the added task of alternating between the numbers and letters (i.e., 1-A-2-B-3-C, etc.). The patient should be instructed to connect the circles as quickly as possible, without lifting the pen or pencil from the paper. Time the patient as he or she connects the "trail." If the patient makes an error, point it out immediately and allow the patient to correct it. Errors affect the patient's score only in that the correction of errors is included in the completion time for the task. It is unnecessary to continue the test if the patient has not completed both parts after five minutes have elapsed.

| | |
|---|---|
| Step 1: | Give the patient a copy of the Trail Making Test Part A worksheet and a pen or pencil. |
| Step 2: | Demonstrate the test to the patient using the sample sheet (Trail Making Part A – *SAMPLE*). |
| Step 3: | Time the patient as he or she follows the “trail” made by the numbers on the test. |
| Step 4: | Record the time. |
| Step 5: | Repeat the procedure for Trail Making Test Part B. |

***Scoring:***

Results for both TMT A and B are reported as the number of seconds required to complete the task; therefore, higher scores reveal greater impairment.

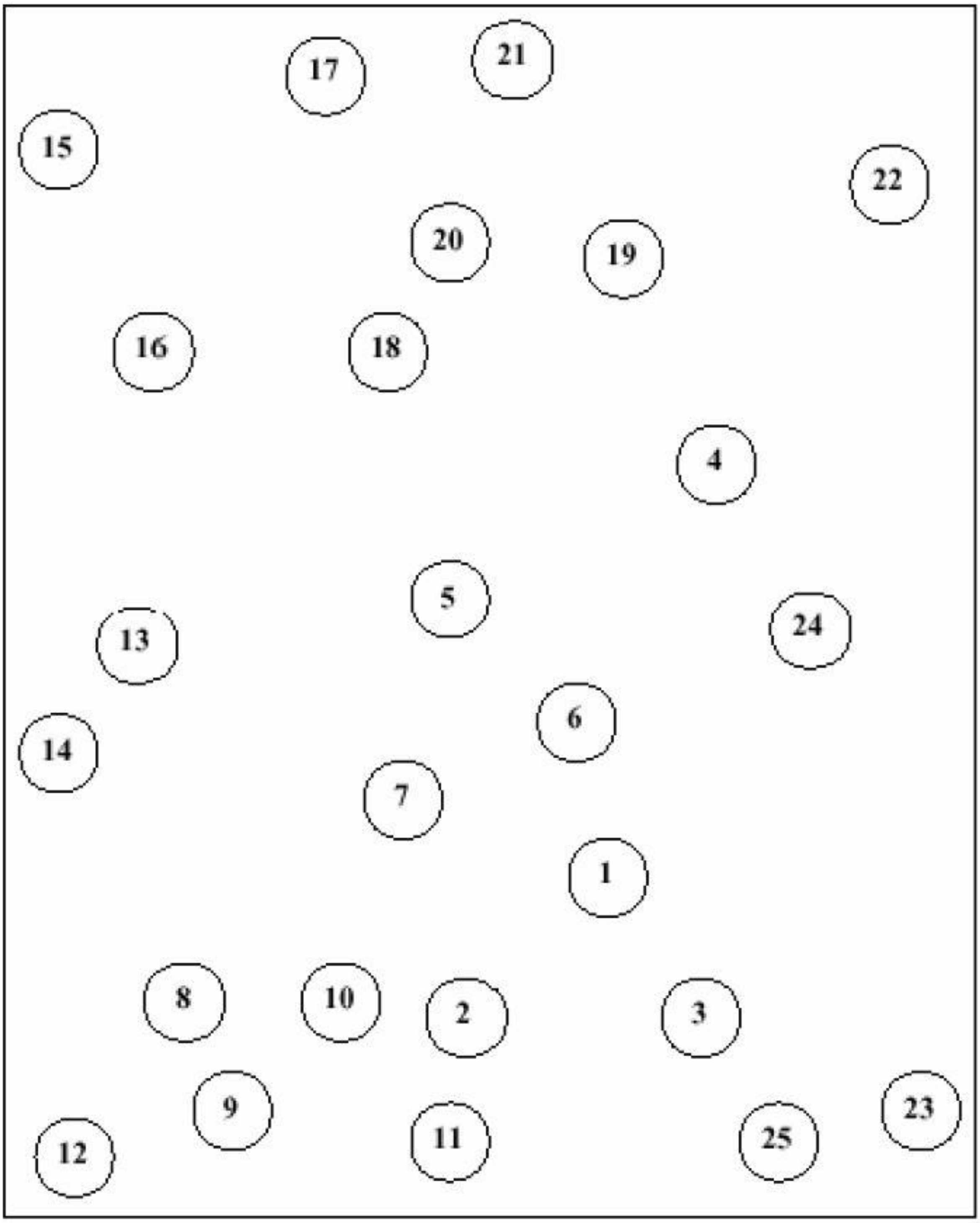
| | **Average** | **Deficient** | **Rule of Thumb** |
|---|---|---|---|
| **Trail A** | 29 seconds | > 78 seconds | Most in 90 seconds |
| **Trail B** | 75 seconds | > 273 seconds | Most in 3 minutes |

***Sources:***


- Corrigan JD, Hinkeldey MS. Relationships between parts A and B of the Trail Making Test. *J Clin Psychol*. 1987;43(4):402–409.
- Gaudino EA, Geisler MW, Squires NK. Construct validity in the Trail Making Test: what makes Part B harder? *J Clin Exp Neuropsychol*. 1995;17(4):529-535.
- Lezak MD, Howieson DB, Loring DW. *Neuropsychological Assessment*. 4th ed. New York: Oxford University Press; 2004.
- Reitan RM. Validity of the Trail Making test as an indicator of organic brain damage. *Percept Mot Skills*. 1958;8:271-276.

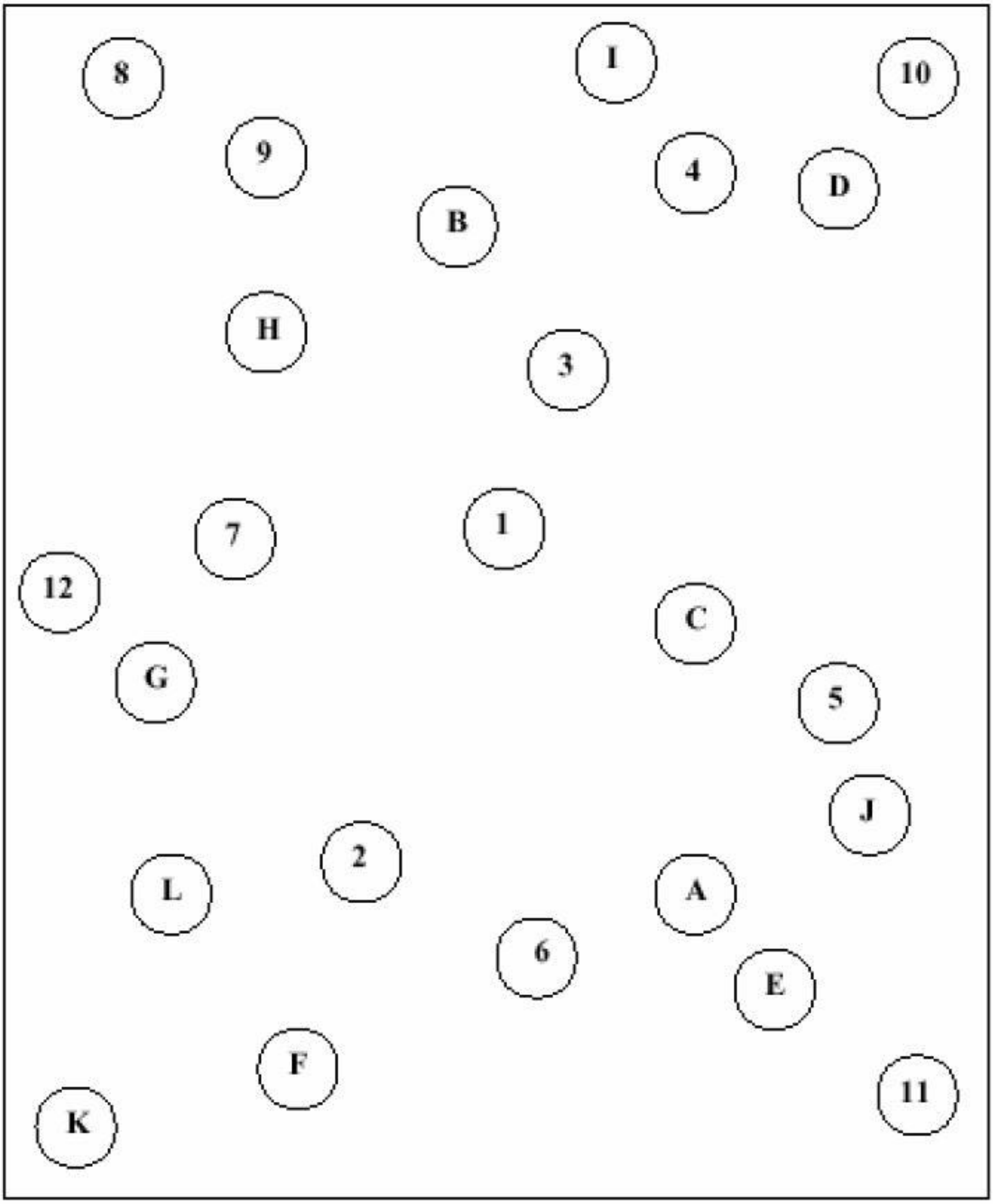
# Trail Making Test Part A

Patient's Name: ______________________________ Date: ____________________



# Trail Making Test Part B

Patient's Name: ______________________________ Date: ____________________



### 6.1.14 Double Letter Cancellation Task

DOUBLE LETTER CANCELLATION TEST (DLCT)

Name:____________ Date:____________ Session:________

Target letters: C J

Cancel the above letters with a slash in the given test, at your maximum speed.

Time allowed: 90 seconds

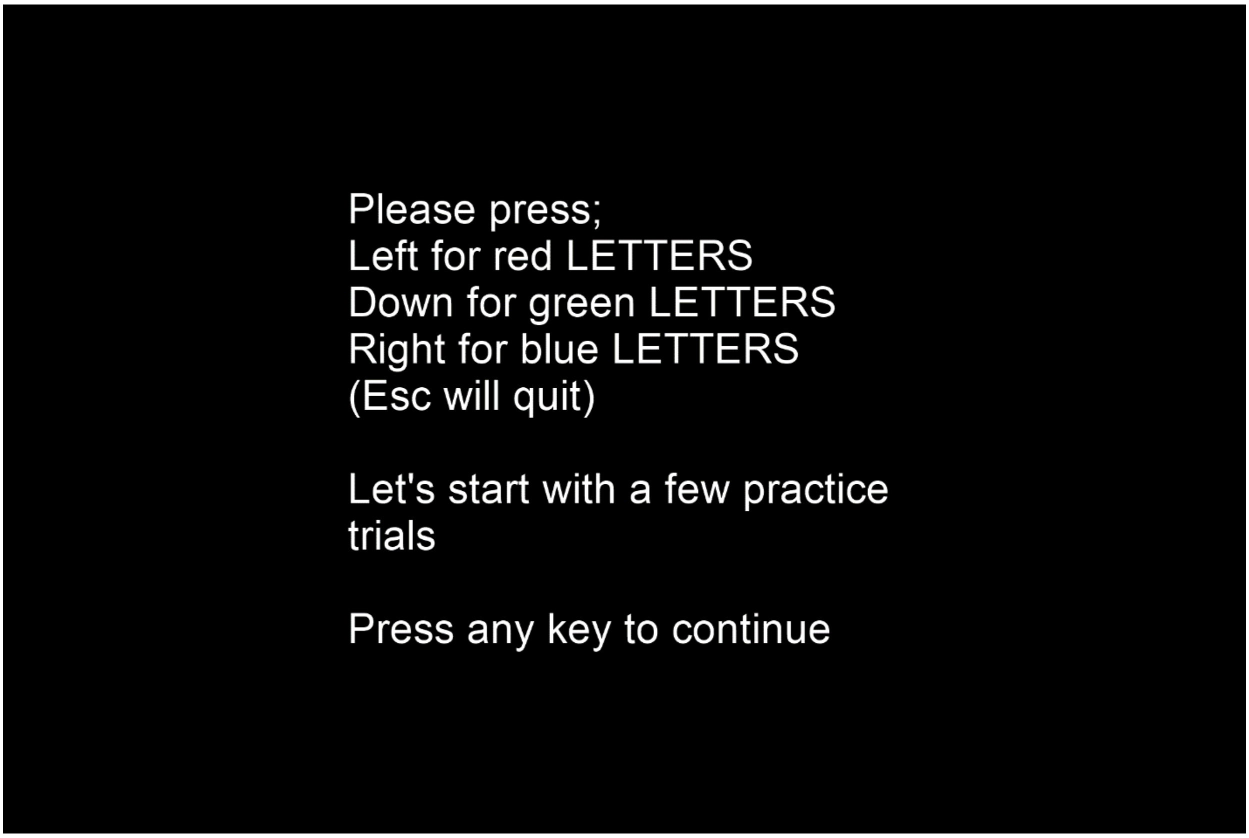
G H J K L O P W S D F U I W O P L E C D F G H K A X V M N D B Q W E U I Q W D S F V F G L K H G U I O
P L K H G B M Q B G F T S D F H G N K L O I J H G F V N M A S W E R I Q E O I W E R T U I O P L K H G F C
B C M N B G S D F G K C D V B N M K L O P U Y T G H F J D S E W Q S C V B N M K L P O H J G F C F G H
Y U K L P W Q W E R T Y H J K F C V B G F D S V F R E D F V G H U K I O P L K H N M H D F G H N B N M K
L F D S W J W R T U Q U G H B N V C X S Z A S D F G T R E D F G H Y U J K L O I H K L E D F G V B J M H G
F D C S W E R T Y Q A S D F H J K L O P Y T R E D F V B N G F D W J X Z H I K C V B G H Y N M J H G F P D
S V B N M J H G F G T R F J E S D V B F D S W E A Z X S D F G H Y T G F R D Y E S D F G H U Y T G F R D E S
C S W A S D V F B N M K L P O I K U H G T F G F D F R D S V G B H Y C H G F R D F G H Y T R E W S D F V
B N H G F D V B N M A Z X S D F G H K L O R T Y S D F V B N M H G F G T Y I O U P L P O Q A S D F G H T
G H N B G V G C U Y H G F D F V B N Q W E R T S J F H T G H D E F G T H Y T G F V B N M L C P I U Q J P I

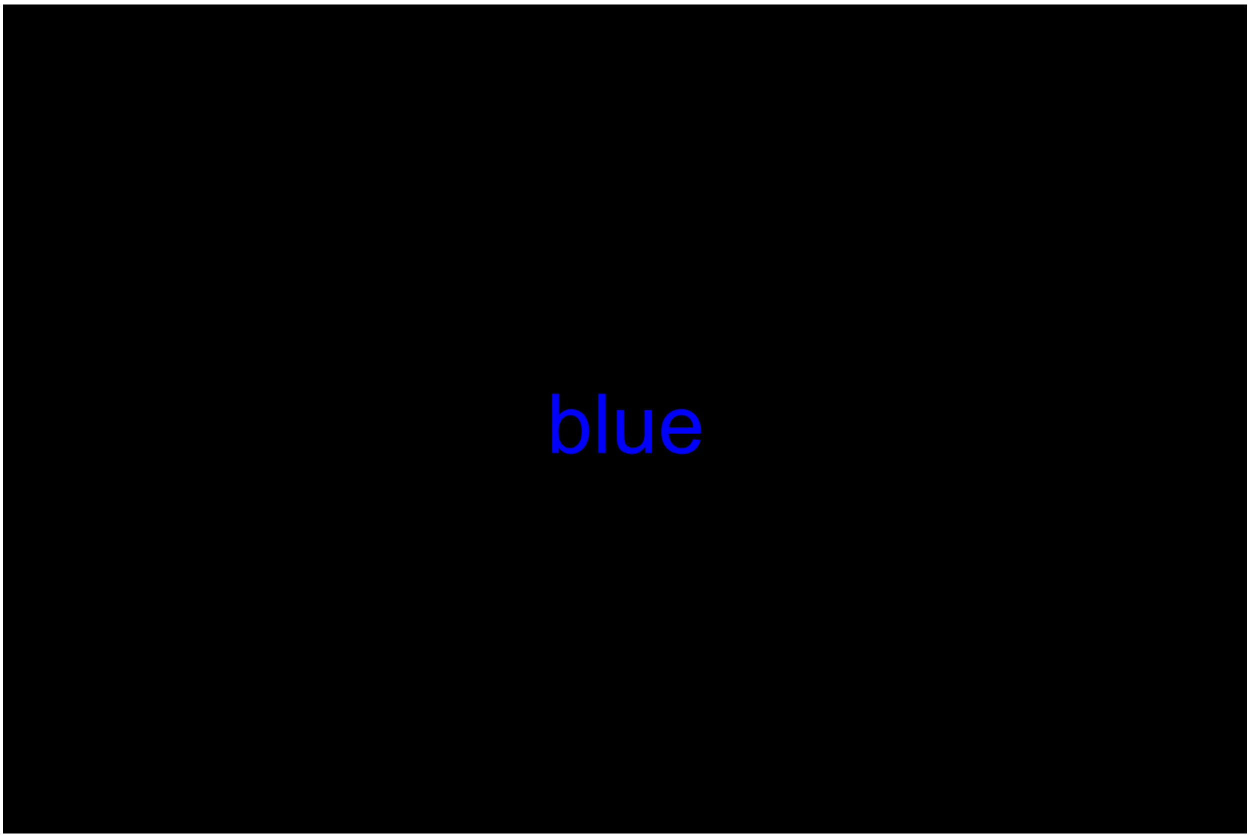
Total attempted:

Incorrect score:

Net score:

#### 6.1.15 Stroop Task



#### 6.1.16 Driving Simulator Manual

# Driving Simulator Manual

# How to use the driving simulator

This is aimed at individuals who have already achieved a driving license and therefore know how to operate a motorised vehicle.

## Contents

## How to start the engine

i. Make sure the engine is not already on
   a. You can find this out by either listening to the sound the engine makes or by looking at the rpm meter if needle is on anything other than 0 rpm on the dashboard, then the engine is on

ii. Press the button highlighted in green on the steering wheel of the simulator

## How to release the handbrake

i. Make sure the handbrake is not already released
   a. You can find this out by looking at the dashboard of the car when the engine is on
   b. If there is a symbol which looks like this  then the parking brake on

ii. Press the button highlighted in green on the steering wheel of the simulator

## How to fasten the seatbelt

i. Make sure the seatbelt is not already fastened
   a. You can find this out by looking in the top left corner of your screen
   b. If there is a symbol which looks like this  then your seatbelt has already been fastened

ii. Press the button highlighted in green on the steering wheel of the simulator

## How to turn on headlights/full beam

i. Make sure the lights are not on already
   a. You can find this out by searching for a symbol which looks like this  or  on the dashboard of the car.
   b. This will indicate if the lights are on dipped mode or full beam if there is nothing showing then the lights are off

ii. Press the button highlighted in green on the steering wheel of the simulator

## How to use the left and right indicators

i. Make sure the indicator lights are not showing already
   a. You can find this out by searching for green arrow key symbols in either the right or left direction on the dashboard of the car.
   b. The indicators will not self-cancel, so it is important that you cancel them.
ii. To activate the indicator, press one of the paddles in the direction you want to indicate.
iii. The paddles are shown in this picture diagram on the wheel

### 6.1.17 Ethics Form

**SCHOOL OF PSYCHOLOGY ETHICAL APPROVAL FORM FOR HUMAN PARTICIPANTS**

*Tick relevant boxes*: ☐ **STAFF Project** X **POSTGRADUATE Project** ☐ **TRACK A**
☐ **UNDERGRADUATE Project** X **TRACK B**
☐ **ROUTINE EXTENSION TO STUDY**

Title Of Project: The role of executive functions on driving ability

Name of researcher: Callum Reynish

Name of supervisor(s): Lesley Allinson, Niko Kargas Date: 20/07/2018

| | | YES | NO | N/A |
|---|---|---|---|---|
| 1 | Will you describe the main procedures to participants in advance, so that they are informed in advance about what to expect? | yes | | |
| 2 | Will you tell participants that their participation is voluntary? | yes | | |
| 3 | Will you obtain written consent for participation? | yes | | |
| 4 | If the research is observational, will you ask participants for their consent to being observed / taped? | | | N/A |
| 5 | Will you tell participants that they may withdraw themselves or their data from the research at any time, that no reason needs to be given, and that they can do so without losing any rewards (if applicable)? | yes | | |
| 6 | Will you give participants the option of declining to give information they do not want to give (e.g., not filling out all questions in a questionnaire)? | yes | | |
| 7 | Will you tell participants that their data will be treated with full confidentiality, and stored securely (for 7 years at the minimum) and that, if published, it will not be identifiable as theirs? | yes | | |
| 8 | Will you debrief participants at the end of their participation (i.e. give them a brief explanation of the study)? | yes | | |

If you have ticked **No** to any of Q1-8, but have **ticked box A** overleaf, please give any explanation on a separate sheet. (Note: N/A = not applicable)

| | | YES | NO | N/A |
|---|---|---|---|---|
| 9 | Will your project involve deliberately misleading participants in any way? | | no | |
| 10 | Is there a realistic risk of any participants experiencing either physical or psychological distress or discomfort? If **Yes**, give details on a separate sheet and state what you will tell them to do if they should experience any problems (e.g. who they can contact for help). | | no | |

If you have ticked **Yes** to 9 or 10 you should normally **tick box B** overleaf; if not, please give a full explanation on a separate sheet.

| | | | YES | NO | N/A |
|---|---|---|---|---|---|
| 11 | Do participants fall into any of the following special groups? If they do, please refer to the appropriate BPS guidelines, and **tick box B** overleaf.<br><br>**Please note that you may also need to gain satisfactory CRB clearance or equivalent for overseas participants.** | School children (under 18 years of age) | | no | |
| | | People with learning or communication difficulties | While this might be a considered a vulnerable group participants will be over 18, hold a driving licence, and hence have the intellectual capacity to have been instructed and to pass such a test. Whilst this could be a Track A – we have included a Track B application should there be doubt. | | |
| | | Patients | | no | |
| | | Those at risk of psychological distress or otherwise vulnerable | | no | |
| | | People in custody | | no | |
| | | People engaged in illegal activities (e.g. drug taking) | | no | |

**There is an obligation on the lead researcher to bring to the attention of the School's Ethics Committee projects with ethical implications not clearly covered by the above checklist.**

PLEASE TICK **EITHER** BOX A or BOX B BELOW AND **PROVIDE THE DETAILS REQUIRED** IN SUPPORT OF YOUR APPLICATION, THEN SIGN THE FORM.

**Please tick:**

| | |
|---|---|
| **A.** I consider that this project has **no** significant ethical implications to be brought before the Departmental Ethics Committee. | |

Research Question: Does executive function training improve driving performance for young adults with autism?

The study is in four parts:

Part 1: Participants will complete an online survey in their own time which consists of demographic questions and a series of self-report questionnaires for Executive Functioning, Autistic traits, Anxiety and Driving behaviour.

Part 2: Participants will

1. Complete a series of paper executive function tests
    a. Stroop test (5 mins)
    b. Trail making test (5 mins)
    c. Forward and backward digit span task (5 mins)
    d. Letter cancellation task (5 mins)

***If any of the above information is missing, your application will be returned to you.***

I am familiar with the BPS Guidelines for ethical practices in psychological research, and the Univer
Regulations for Ethical Research (and have discussed them with other researchers involved in the p
my supervisor)

Signed……………………………………………………… Print Name…Callum Reynish...

Date……12/08/2018………

*(UG/PG Researcher(s), if applicable)* Email…CReynish@lincoln.ac.uk…………………………

Signed………………………………………………Print Name…Lesley Allinson……

Date…10/08/2018……

*(Lead Researcher or Supervisor)* Email…lallinson@lincoln.ac.uk……………………………

***STATEMENT OF ETHICAL APPROVAL***

This project has been considered using agreed Departmental procedures and is now approved.

Signed……………………………………………Print
Name…………………………………………….Date……………….

*(Chair, Departmental Ethics Committee)*

## 6.2 Raw SPSS Output

### 6.2.1 Factor Analysis of DBQ

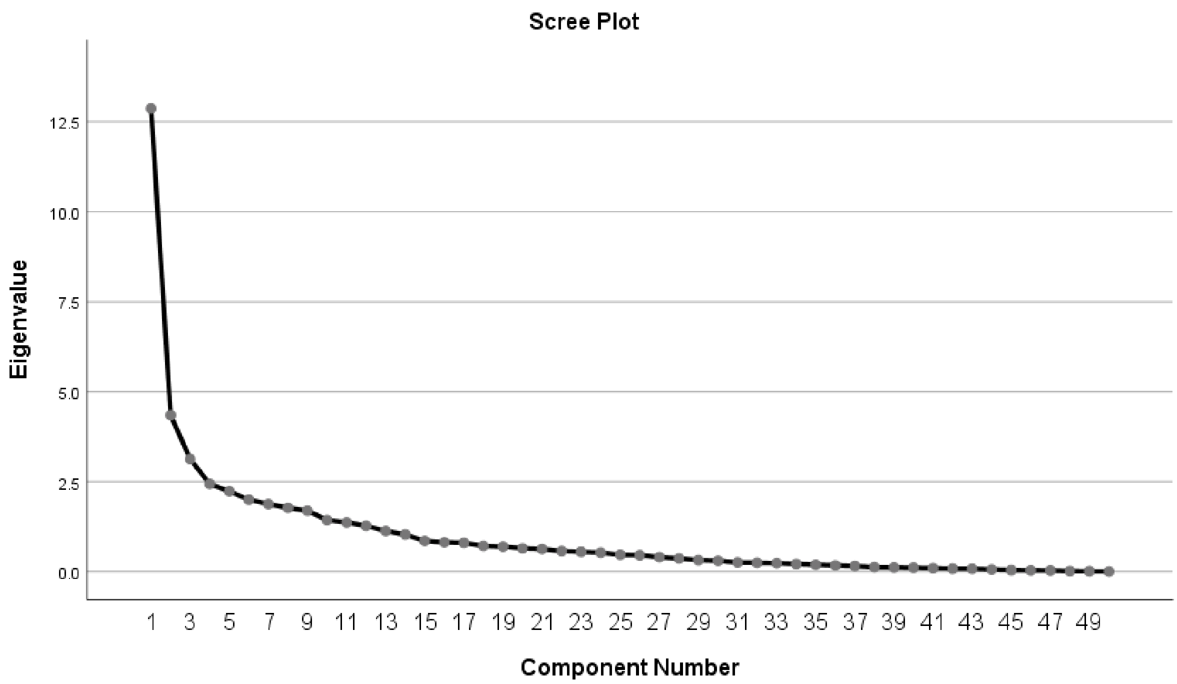
*Initial Factor Analysis*

**Total Variance Explained**

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 12.867 | 25.733 | 25.733 | 12.867 | 25.733 | 25.733 |
| 2 | 4.348 | 8.695 | 34.429 | 4.348 | 8.695 | 34.429 |
| 3 | 3.128 | 6.256 | 40.685 | 3.128 | 6.256 | 40.685 |
| 4 | 2.438 | 4.875 | 45.561 | 2.438 | 4.875 | 45.561 |
| 5 | 2.232 | 4.463 | 50.024 | 2.232 | 4.463 | 50.024 |
| 6 | 2.000 | 4.001 | 54.025 | 2.000 | 4.001 | 54.025 |
| 7 | 1.878 | 3.755 | 57.780 | 1.878 | 3.755 | 57.780 |
| 8 | 1.772 | 3.544 | 61.324 | 1.772 | 3.544 | 61.324 |
| 9 | 1.694 | 3.388 | 64.712 | 1.694 | 3.388 | 64.712 |
| 10 | 1.433 | 2.866 | 67.578 | 1.433 | 2.866 | 67.578 |
| 11 | 1.369 | 2.738 | 70.316 | 1.369 | 2.738 | 70.316 |
| 12 | 1.272 | 2.544 | 72.861 | 1.272 | 2.544 | 72.861 |
| 13 | 1.131 | 2.262 | 75.123 | 1.131 | 2.262 | 75.123 |
| 14 | 1.031 | 2.063 | 77.186 | 1.031 | 2.063 | 77.186 |
| 15 | .856 | 1.711 | 78.897 | | | |
| 16 | .814 | 1.627 | 80.524 | | | |
| 17 | .799 | 1.597 | 82.121 | | | |
| 18 | .715 | 1.429 | 83.550 | | | |
| 19 | .696 | 1.391 | 84.942 | | | |
| 20 | .647 | 1.295 | 86.237 | | | |
| 21 | .629 | 1.259 | 87.496 | | | |
| 22 | .569 | 1.138 | 88.634 | | | |
| 23 | .549 | 1.099 | 89.732 | | | |
| 24 | .525 | 1.050 | 90.782 | | | |
| 25 | .470 | .940 | 91.722 | | | |
| 26 | .456 | .912 | 92.634 | | | |
| 27 | .403 | .806 | 93.441 | | | |
| 28 | .365 | .729 | 94.170 | | | |
| 29 | .319 | .639 | 94.809 | | | |
| 30 | .302 | .604 | 95.413 | | | |
| 31 | .256 | .513 | 95.926 | | | |
| 32 | .246 | .493 | 96.419 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 33 | .237 | .473 | 96.892 | | | |
| 34 | .212 | .424 | 97.316 | | | |
| 35 | .194 | .387 | 97.704 | | | |
| 36 | .174 | .347 | 98.051 | | | |
| 37 | .156 | .313 | 98.364 | | | |
| 38 | .124 | .249 | 98.612 | | | |
| 39 | .115 | .230 | 98.843 | | | |
| 40 | .109 | .218 | 99.060 | | | |
| 41 | .094 | .189 | 99.249 | | | |
| 42 | .083 | .166 | 99.414 | | | |
| 43 | .080 | .160 | 99.575 | | | |
| 44 | .062 | .124 | 99.699 | | | |
| 45 | .043 | .085 | 99.784 | | | |
| 46 | .037 | .074 | 99.859 | | | |
| 47 | .033 | .067 | 99.925 | | | |
| 48 | .018 | .036 | 99.961 | | | |
| 49 | .014 | .028 | 99.989 | | | |
| 50 | .005 | .011 | 100.000 | | | |

Extraction Method: Principal Component Analysis.




**Rotated Component Matrix[a]**

a. Rotation failed to converge in 25 iterations. (Convergence = .000).

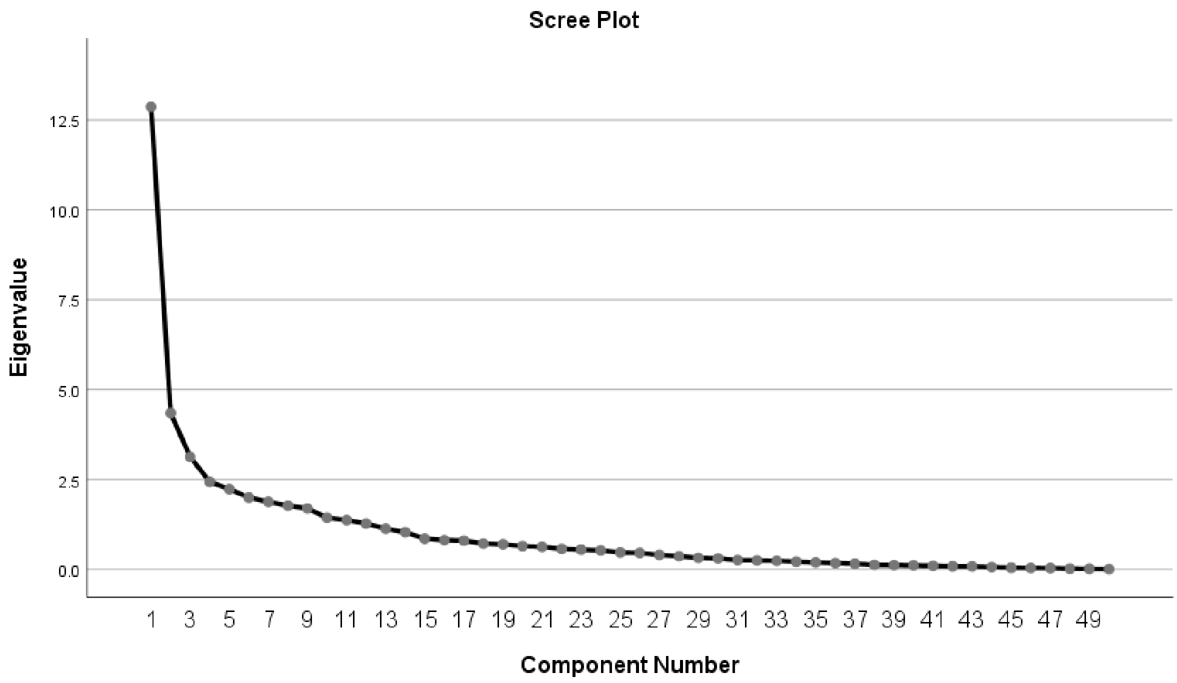
***Four Factor Solution***

**Total Variance Explained**

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 12.867 | 25.733 | 25.733 | 12.867 | 25.733 | 25.733 | 6.495 | 12.990 | 12.990 |
| 2 | 4.348 | 8.695 | 34.429 | 4.348 | 8.695 | 34.429 | 5.580 | 11.161 | 24.150 |
| 3 | 3.128 | 6.256 | 40.685 | 3.128 | 6.256 | 40.685 | 5.484 | 10.967 | 35.118 |
| 4 | 2.438 | 4.875 | 45.561 | 2.438 | 4.875 | 45.561 | 5.221 | 10.443 | 45.561 |
| 5 | 2.232 | 4.463 | 50.024 | | | | | | |
| 6 | 2.000 | 4.001 | 54.025 | | | | | | |
| 7 | 1.878 | 3.755 | 57.780 | | | | | | |
| 8 | 1.772 | 3.544 | 61.324 | | | | | | |
| 9 | 1.694 | 3.388 | 64.712 | | | | | | |
| 10 | 1.433 | 2.866 | 67.578 | | | | | | |
| 11 | 1.369 | 2.738 | 70.316 | | | | | | |
| 12 | 1.272 | 2.544 | 72.861 | | | | | | |
| 13 | 1.131 | 2.262 | 75.123 | | | | | | |
| 14 | 1.031 | 2.063 | 77.186 | | | | | | |
| 15 | .856 | 1.711 | 78.897 | | | | | | |
| 16 | .814 | 1.627 | 80.524 | | | | | | |
| 17 | .799 | 1.597 | 82.121 | | | | | | |
| 18 | .715 | 1.429 | 83.550 | | | | | | |
| 19 | .696 | 1.391 | 84.942 | | | | | | |
| 20 | .647 | 1.295 | 86.237 | | | | | | |
| 21 | .629 | 1.259 | 87.496 | | | | | | |
| 22 | .569 | 1.138 | 88.634 | | | | | | |
| 23 | .549 | 1.099 | 89.732 | | | | | | |
| 24 | .525 | 1.050 | 90.782 | | | | | | |
| 25 | .470 | .940 | 91.722 | | | | | | |
| 26 | .456 | .912 | 92.634 | | | | | | |
| 27 | .403 | .806 | 93.441 | | | | | | |
| 28 | .365 | .729 | 94.170 | | | | | | |
| 29 | .319 | .639 | 94.809 | | | | | | |
| 30 | .302 | .604 | 95.413 | | | | | | |
| 31 | .256 | .513 | 95.926 | | | | | | |
| 32 | .246 | .493 | 96.419 | | | | | | |
| 33 | .237 | .473 | 96.892 | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 34 | .212 | .424 | 97.316 | | | | | | |
| 35 | .194 | .387 | 97.704 | | | | | | |
| 36 | .174 | .347 | 98.051 | | | | | | |
| 37 | .156 | .313 | 98.364 | | | | | | |
| 38 | .124 | .249 | 98.612 | | | | | | |
| 39 | .115 | .230 | 98.843 | | | | | | |
| 40 | .109 | .218 | 99.060 | | | | | | |
| 41 | .094 | .189 | 99.249 | | | | | | |
| 42 | .083 | .166 | 99.414 | | | | | | |
| 43 | .080 | .160 | 99.575 | | | | | | |
| 44 | .062 | .124 | 99.699 | | | | | | |
| 45 | .043 | .085 | 99.784 | | | | | | |
| 46 | .037 | .074 | 99.859 | | | | | | |
| 47 | .033 | .067 | 99.925 | | | | | | |
| 48 | .018 | .036 | 99.961 | | | | | | |
| 49 | .014 | .028 | 99.989 | | | | | | |
| 50 | .005 | .011 | 100.000 | | | | | | |

Extraction Method: Principal Component Analysis.



**Rotated Component Matrix**

| | Component 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Q1 Attempt to drive away from traffic lights in third gear S A | | | .317 | |
| Q2 Check your speedometer and discover that you are unknowingly travelling faster that the legal limit UV B | .483 | | .452 | |
| Q3 Lock yourself out of your car with the keys still inside S A | | | | |
| Q4 Become impatient with a slow driver in the outer lane and overtake on the inside V C | | | | .495 |
| Q5 Drive as fast along country roads at night on dipped lights as on full beam M B | | | .378 | .587 |
| Q6 Attempt to drive away without first having switched on the ignition S A | | .320 | .532 | |
| Q7 Drive especially close or "flash" the car in front as a signal for that driver to go faster or get out of your way V C | | | .582 | .440 |
| Q8 Forget where you left your car in a multi-level car park S A | .588 | | | |
| Q9 Distracted or preoccupied, realise belatedly that the vehicle ahead has slowed, and have to slam on the brakes to avoid a collision S C | .458 | | | .555 |
| Q10 Intend to switch on the windscreen wipers, but switch off the lights instead, or vice versa S A | .642 | | | |
| Q11 Turn left on to a main road into the path of an oncoming vehicle that you hadn't seen, or whose speed you had misjudged M C | .361 | | | |
| Q12 Misjudge your gap in a car park and nearly (or actually) hit adjoining vehicle M B | .548 | | | |
| Q13 "Wake up" to realise that you have no clear recollection of the road along which you have just travelled S A | .669 | | | |
| Q14 Miss your exit on a motorway and have to make a lengthy detour S A | | .301 | .425 | |
| Q15 Forget which gear you are currently in and have to check with your hand S A | .726 | | | |

| | | | | |
|---|---|---|---|---|
| Q16 Stuck behind a slow-moving vehicle on a two-lane highway, you are driven by frustration to try to overtake in risky circumstances V C | | | | .564 |
| Q17 Intending to drive to destination A, you “wake up” to find yourself en route to B, where the latter is the more usual journey S A | .644 | | .347 | |
| Q18 Take a chance and cross on lights that have turned red V C | | | .369 | |
| Q19 Angered by another driver's behaviour, you give chase with the intention of giving him/her a piece of your mind V C | | | | .706 |
| Q20 Try to overtake without first checking your mirror, and then get hooted at by the car behind which has already begun it’s overtaking manoeuvre S C | | .692 | | |
| Q21 Deliberately disregard the speed limits late at night or very early in the morning V C | | | .631 | .354 |
| Q22 Forget when your road tax/insurance expires and discover that you are driving illegally UV A | | | | |
| Q23 Lost in thought, you forget that your lights are on full beam until “flashed” by other motorists S B | .475 | | | |
| Q24 On turning left, nearly hit a cyclist who has come up on your inside S C | | .305 | | |
| Q25 In a queue of vehicles turning left on to a main road, pay such close attention to the traffic approaching from the right that you nearly hit the car in front S B | .443 | .509 | | |
| Q26 Drive back from a party, restaurant, or pub, even though you realise that you may be over the legal blood-alcohol limit V C | | | .318 | .402 |
| Q27 Have an aversion to a particular class of road user, and indicate your hostility by whatever means you can V B | | | | |

| | | | | |
|---|---|---|---|---|
| Q28 Lost in thought or distracted, you fail to notice someone waiting at a zebra crossing, or a pelican crossing light that has just turned red UV C | .599 | .409 | | |
| Q29 Park on a double-yellow line and risk a fine V A | | | .578 | .406 |
| Q30 Misjudge speed of oncoming vehicle when overtaking S C | | .540 | .325 | .333 |
| Q31 Hit something when reversing that you had not previously seen M B | .385 | | | .634 |
| Q32 Fail to notice someone stepping out from behind a bus or parked vehicle until it is nearly too late S C | | .564 | | |
| Q33 Plan your route badly, so that you meet traffic congestion you could have avoided M A | .470 | .395 | | |
| Q34 Overtake a single line of stationary or slow-moving vehicles, only to discover that they were queuing to get through a one-lane gap or roadwork lights M A | .382 | .623 | .302 | |
| Q35 Overtake a slow-moving vehicle on the inside lane or hard shoulder of a motorway V C | | .473 | .482 | |
| Q36 Cut the corner on a right-hand turn and have to swerve violently to avoid an oncoming vehicle V C | | .650 | .438 | |
| Q37 Get into the wrong lane at a roundabout or approaching a road junction M A | .711 | | | |
| Q38 Fail to read the signs correctly, and exit from a roundabout on the wrong road S A | .571 | .505 | | |
| Q39 Fail to give way when a bus is signalling its intention to pull out V B | .479 | | | |
| Q40 Ignore “give way” signs, and narrowly avoid colliding with traffic having right of way V C | | .723 | | |
| Q41 Fail to check your mirror before pulling out, changing lanes, turning, etc S C | .302 | .354 | | |
| Q42 Attempt to overtake a vehicle that you hadn't noticed was signalling its intention to turn right S C | | .785 | | |

| | | | | |
|---|---|---|---|---|
| Q43 Deliberately drive the wrong way down a deserted one-way street V C | | .414 | .484 | |
| Q44 Disregard red lights when driving late at night along empty roads V C | | .347 | .523 | .535 |
| Q45 Drive with only “half-an-eye” on the road while looking at a map, changing a cassette or radio channel, etc S C | .444 | | .402 | |
| Q46 Fail to notice pedestrians crossing when turning into a side-street from a main road S C | .439 | | .346 | |
| Q47 Get involved in unofficial “races” with other drivers V C | | | .700 | |
| Q48 “Race” oncoming vehicles for a one-car gap on a narrow or obstructed road V C | | | .752 | |
| Q49 Brake too quickly on a slippery road and/or steer the wrong way in a skid M C | | | | .787 |
| Q50 Misjudge your crossing interval when turning right and narrowly miss collision M C | | .347 | | .643 |

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 12 iterations.

### 6.2.2 Correlational Analysis

***BRIEF-A and DBQ***

**Correlations**

| | | | Inhibit | Shift | Emotional Control | Self-Monitor | Initiate | Working Memory | Plan/Organise | Task Monitor | Organisation of Materials | Absent minded | Close Encounters | Risky Driving | Dangerous Driving |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spearman's rho | Inhibit | Correlation Coefficient | 1.000 | .579** | .656** | .725** | .637** | .680** | .642** | .668** | .363** | .226 | .227 | .170 | .346** |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sig. (2-tailed) | . | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .002 | .068 | .069 | .179 | .005 |
| | N | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 | 66 | 65 | 64 | 65 |
| Shift | Correlation Coefficient | .579** | 1.000 | .502** | .429** | .598** | .744** | .614** | .637** | .114 | .269* | .287* | .084 | .215 |
| | Sig. (2-tailed) | .000 | . | .000 | .000 | .000 | .000 | .000 | .000 | .353 | .029 | .021 | .511 | .085 |
| | N | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 | 66 | 65 | 64 | 65 |
| Emotional Control | Correlation Coefficient | .656** | .502** | 1.000 | .421** | .548** | .432** | .433** | .443** | .183 | .300* | .286* | .110 | .100 |
| | Sig. (2-tailed) | .000 | .000 | . | .000 | .000 | .000 | .000 | .000 | .135 | .015 | .022 | .392 | .432 |
| | N | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 65 | 64 | 63 | 64 |
| Self-Monitor | Correlation Coefficient | .725** | .429** | .421** | 1.000 | .395** | .560** | .589** | .516** | .302* | .112 | .166 | .212 | .406** |
| | Sig. (2-tailed) | .000 | .000 | .000 | . | .001 | .000 | .000 | .000 | .012 | .373 | .185 | .093 | .001 |
| | N | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 | 66 | 65 | 64 | 65 |
| Initiate | Correlation Coefficient | .637** | .598** | .548** | .395** | 1.000 | .658** | .747** | .725** | .361** | .191 | .239 | .222 | .152 |
| | Sig. (2-tailed) | .000 | .000 | .000 | .001 | . | .000 | .000 | .000 | .002 | .125 | .055 | .078 | .226 |
| | N | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 | 66 | 65 | 64 | 65 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Working Memory | Correlation Coefficient | .680** | .744** | .432** | .560** | .658** | 1.000 | .768** | .748** | .406** | .341** | .296* | .089 | .235 |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | .000 | . | .000 | .000 | .001 | .005 | .017 | .486 | .059 |
| | N | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 | 66 | 65 | 64 | 65 |
| Plan/Organise | Correlation Coefficient | .642** | .614** | .433** | .589** | .747** | .768** | 1.000 | .786** | .462** | .250* | .246* | .239 | .312* |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | .000 | .000 | . | .000 | .000 | .043 | .048 | .058 | .011 |
| | N | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 | 66 | 65 | 64 | 65 |
| Task Monitor | Correlation Coefficient | .668** | .637** | .443** | .516** | .725** | .748** | .786** | 1.000 | .390** | .175 | .241 | .140 | .160 |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | .000 | .000 | .000 | . | .001 | .160 | .053 | .271 | .204 |
| | N | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 | 66 | 65 | 64 | 65 |
| Organisation of Materials | Correlation Coefficient | .363** | .114 | .183 | .302* | .361** | .406** | .462** | .390** | 1.000 | .113 | .181 | .334** | .333** |
| | Sig. (2-tailed) | .002 | .353 | .135 | .012 | .002 | .001 | .000 | .001 | . | .364 | .149 | .007 | .007 |
| | N | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 | 66 | 65 | 64 | 65 |
| Absent minded | Correlation Coefficient | .226 | .269* | .300* | .112 | .191 | .341** | .250* | .175 | .113 | 1.000 | .588** | .380** | .459** |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sig. (2-tailed) | .068 | .029 | .015 | .373 | .125 | .005 | .043 | .160 | .364 | . | .000 | .002 | .000 |
| | N | 66 | 66 | 65 | 66 | 66 | 66 | 66 | 66 | 66 | 66 | 65 | 64 | 65 |
| Close Encounters | Correlation Coefficient | .227 | .287* | .286* | .166 | .239 | .296* | .246* | .241 | .181 | .588** | 1.000 | .418** | .348** |
| | Sig. (2-tailed) | .069 | .021 | .022 | .185 | .055 | .017 | .048 | .053 | .149 | .000 | . | .001 | .005 |
| | N | 65 | 65 | 64 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 63 | 65 |
| Risky Driving | Correlation Coefficient | .170 | .084 | .110 | .212 | .222 | .089 | .239 | .140 | .334** | .380** | .418** | 1.000 | .557** |
| | Sig. (2-tailed) | .179 | .511 | .392 | .093 | .078 | .486 | .058 | .271 | .007 | .002 | .001 | . | .000 |
| | N | 64 | 64 | 63 | 64 | 64 | 64 | 64 | 64 | 64 | 64 | 63 | 64 | 63 |
| Dangerous Driving | Correlation Coefficient | .346** | .215 | .100 | .406** | .152 | .235 | .312* | .160 | .333** | .459** | .348** | .557** | 1.000 |
| | Sig. (2-tailed) | .005 | .085 | .432 | .001 | .226 | .059 | .011 | .204 | .007 | .000 | .005 | .000 | . |
| | N | 65 | 65 | 64 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 65 | 63 | 65 |

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

**Correlations**

| | | | Digit Span Task z-scores | Trail Making Task B-A | Stroop Task incong-cong | Double Letter Cancellation Test Total | No of times did not signal | No of times went off of the road | No of times driving in opposite lane | No of times crossed solid white lines | No of times speed limit was broken | No of times getting into a traffic accident | No of times having an accident with a pedestrian | No of times did not yield to pedestrian crossing | No of times stopped on a pedestrian crossing | No of times right of way was violated | No of times running a red light |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spearman's rho | Digit Span Task z-scores | Correlation Coefficient | 1.000 | -.001 | -.084 | .277 | .175 | -.066 | .075 | -.061 | .045 | -.024 | .220 | .095 | -.084 | .244 | .005 |
| | | Sig. (2-tailed) | . | .996 | .689 | .154 | .414 | .761 | .726 | .778 | .835 | .910 | .302 | .657 | .697 | .250 | .980 |
| | | N | 28 | 27 | 25 | 28 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| | Trail Making Task B-A | Correlation Coefficient | -.001 | 1.000 | -.288 | -.128 | -.062 | -.294 | .207 | -.024 | -.028 | -.018 | -.209 | -.143 | .300 | -.097 | -.406* |
| | | Sig. (2-tailed) | .996 | . | .163 | .524 | .775 | .163 | .331 | .912 | .897 | .934 | .326 | .506 | .154 | .651 | .049 |
| | | N | 27 | 27 | 25 | 27 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stroop Task incong-cong | Correlation Coefficient | -.084 | -.288 | 1.000 | .150 | .081 | .574** | -.052 | .221 | -.114 | -.068 | .389 | .117 | .183 | .439* | .257 |
| | Sig. (2-tailed) | .689 | .163 | . | .474 | .713 | .004 | .815 | .311 | .604 | .758 | .066 | .595 | .402 | .036 | .236 |
| | N | 25 | 25 | 25 | 25 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| Double Letter Cancellation Test Total | Correlation Coefficient | .277 | -.128 | .150 | 1.000 | .309 | .276 | .229 | -.154 | -.102 | -.186 | .431* | .049 | -.223 | .408* | .371 |
| | Sig. (2-tailed) | .154 | .524 | .474 | . | .142 | .191 | .282 | .471 | .635 | .385 | .036 | .819 | .296 | .048 | .074 |
| | N | 28 | 27 | 25 | 28 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| No of times did not signal | Correlation Coefficient | .175 | -.062 | .081 | .309 | 1.000 | .318 | .450* | .262 | -.077 | .310 | .427* | .110 | -.259 | .146 | .202 |
| | Sig. (2-tailed) | .414 | .775 | .713 | .142 | . | .130 | .027 | .216 | .722 | .140 | .037 | .609 | .221 | .496 | .345 |
| | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| No of times went off of the road | Correlation Coefficient | -.066 | -.294 | .574** | .276 | .318 | 1.000 | .240 | .202 | -.108 | .350 | .468* | .240 | -.109 | .208 | .344 |
| | Sig. (2-tailed) | .761 | .163 | .004 | .191 | .130 | . | .259 | .344 | .617 | .094 | .021 | .258 | .612 | .330 | .100 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| No of times driving in opposite lane | Correlation Coefficient | .075 | .207 | -.052 | .229 | .450* | .240 | 1.000 | .286 | -.275 | .013 | .312 | .387 | .036 | -.053 | .008 |
| | Sig. (2-tailed) | .726 | .331 | .815 | .282 | .027 | .259 | . | .176 | .194 | .951 | .138 | .062 | .867 | .806 | .972 |
| | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| No of times crossed solid white lines | Correlation Coefficient | -.061 | -.024 | .221 | -.154 | .262 | .202 | .286 | 1.000 | -.089 | -.030 | .100 | .509* | -.105 | -.179 | .138 |
| | Sig. (2-tailed) | .778 | .912 | .311 | .471 | .216 | .344 | .176 | . | .679 | .891 | .642 | .011 | .624 | .402 | .520 |
| | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| No of times speed limit was broken | Correlation Coefficient | .045 | -.028 | -.114 | -.102 | -.077 | -.108 | -.275 | -.089 | 1.000 | .294 | -.029 | -.058 | -.216 | -.078 | .037 |
| | Sig. (2-tailed) | .835 | .897 | .604 | .635 | .722 | .617 | .194 | .679 | . | .163 | .892 | .789 | .311 | .718 | .864 |
| | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| No of times getting into | Correlation Coefficient | -.024 | -.018 | -.068 | -.186 | .310 | .350 | .013 | -.030 | .294 | 1.000 | .116 | -.118 | -.242 | -.320 | .035 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a traffic accident | Sig. (2-tailed) | .910 | .934 | .758 | .385 | .140 | .094 | .951 | .891 | .163 | . | .590 | .583 | .254 | .127 | .872 |
| | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| No of times having an accident with a pedestrian | Correlation Coefficient | .220 | -.209 | .389 | .431* | .427* | .468* | .312 | .100 | -.029 | .116 | 1.000 | .348 | -.020 | .173 | -.053 |
| | Sig. (2-tailed) | .302 | .326 | .066 | .036 | .037 | .021 | .138 | .642 | .892 | .590 | . | .096 | .925 | .419 | .805 |
| | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| No of times did not yield to pedestrian crossing | Correlation Coefficient | .095 | -.143 | .117 | .049 | .110 | .240 | .387 | .509* | -.058 | -.118 | .348 | 1.000 | .128 | -.181 | .177 |
| | Sig. (2-tailed) | .657 | .506 | .595 | .819 | .609 | .258 | .062 | .011 | .789 | .583 | .096 | . | .550 | .397 | .408 |
| | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| No of times stopped on a pedestrian crossing | Correlation Coefficient | -.084 | .300 | .183 | -.223 | -.259 | -.109 | .036 | -.105 | -.216 | -.242 | -.020 | .128 | 1.000 | -.173 | -.303 |
| | Sig. (2-tailed) | .697 | .154 | .402 | .296 | .221 | .612 | .867 | .624 | .311 | .254 | .925 | .550 | . | .419 | .151 |
| | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No of times right of way was violated | Correlation Coefficient | .244 | -.097 | .439* | .408* | .146 | .208 | -.053 | -.179 | -.078 | -.320 | .173 | -.181 | -.173 | 1.000 | .363 |
| | | Sig. (2-tailed) | .250 | .651 | .036 | .048 | .496 | .330 | .806 | .402 | .718 | .127 | .419 | .397 | .419 | . | .081 |
| | | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| | No of times running a red light | Correlation Coefficient | .005 | -.406* | .257 | .371 | .202 | .344 | .008 | .138 | .037 | .035 | -.053 | .177 | -.303 | .363 | 1.000 |
| | | Sig. (2-tailed) | .980 | .049 | .236 | .074 | .345 | .100 | .972 | .520 | .864 | .872 | .805 | .408 | .151 | .081 | . |
| | | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

**Correlations**

| | | | Digit Span Task z-scores | Trail Making Task B-A | Stroop Task incong-cong | Double Letter Cancellation Test Total | Inhibit | Shift | Emotional Control | Self-Monitor | Initiate | Working Memory | Plan/Organise | Task Monitor | Organisation of Materials | Behavioural Regulation Index | Metacognition Index | Global Executive Composite |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spearman's rho | Digit Span Task z-scores | Correlation Coefficient | 1.000 | -.001 | -.084 | .277 | .093 | -.006 | .172 | .137 | -.150 | .047 | .156 | -.084 | -.328 | .111 | -.044 | .024 |
| | | Sig. (2-tailed) | . | .996 | .689 | .154 | .651 | .978 | .412 | .504 | .466 | .821 | .445 | .682 | .102 | .589 | .831 | .908 |
| | | N | 28 | 27 | 25 | 28 | 26 | 26 | 25 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 |
| | Trail Making Task B-A | Correlation Coefficient | -.001 | 1.000 | -.288 | -.128 | .170 | -.109 | .112 | -.105 | -.001 | -.120 | -.004 | .039 | .500** | .027 | .076 | .057 |
| | | Sig. (2-tailed) | .996 | . | .163 | .524 | .406 | .598 | .595 | .611 | .996 | .558 | .983 | .848 | .009 | .895 | .711 | .783 |
| | | N | 27 | 27 | 25 | 27 | 26 | 26 | 25 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stroop Task incong-cong | Correlation Coefficient | -.084 | -.288 | 1.000 | .150 | -.035 | .002 | -.072 | -.101 | .023 | -.090 | -.110 | .070 | .098 | -.068 | .066 | -.012 |
| | Sig. (2-tailed) | .689 | .163 | . | .474 | .869 | .991 | .739 | .632 | .912 | .669 | .602 | .739 | .640 | .748 | .754 | .955 |
| | N | 25 | 25 | 25 | 25 | 25 | 25 | 24 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| Double Letter Cancellation Test Total | Correlation Coefficient | .277 | -.128 | .150 | 1.000 | -.098 | -.300 | -.139 | -.117 | -.314 | -.215 | -.167 | -.212 | -.108 | -.152 | -.262 | -.243 |
| | Sig. (2-tailed) | .154 | .524 | .474 | . | .633 | .136 | .507 | .570 | .118 | .291 | .414 | .298 | .599 | .459 | .195 | .231 |
| | N | 28 | 27 | 25 | 28 | 26 | 26 | 25 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 |
| Inhibit | Correlation Coefficient | .093 | .170 | -.035 | -.098 | 1.000 | .579** | .656** | .725** | .637** | .680** | .642** | .668** | .363** | .889** | .699** | .866** |
| | Sig. (2-tailed) | .651 | .406 | .869 | .633 | . | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .002 | .000 | .000 | .000 |
| | N | 26 | 26 | 25 | 26 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |
| Shift | Correlation Coefficient | -.006 | -.109 | .002 | -.300 | .579** | 1.000 | .502** | .429** | .598** | .744** | .614** | .637** | .114 | .747** | .658** | .752** |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sig. (2-tailed) | .978 | .598 | .991 | .136 | .000 | . | .000 | .000 | .000 | .000 | .000 | .000 | .353 | .000 | .000 | .000 |
| | N | 26 | 26 | 25 | 26 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |
| Emotional Control | Correlation Coefficient | .172 | .112 | -.072 | -.139 | .656** | .502** | 1.000 | .421** | .548** | .432** | .433** | .443** | .183 | .858** | .487** | .726** |
| | Sig. (2-tailed) | .412 | .595 | .739 | .507 | .000 | .000 | . | .000 | .000 | .000 | .000 | .000 | .135 | .000 | .000 | .000 |
| | N | 25 | 25 | 24 | 25 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 |
| Self-Monitor | Correlation Coefficient | .137 | -.105 | -.101 | -.117 | .725** | .429** | .421** | 1.000 | .395** | .560** | .589** | .516** | .302* | .709** | .561** | .678** |
| | Sig. (2-tailed) | .504 | .611 | .632 | .570 | .000 | .000 | .000 | . | .001 | .000 | .000 | .000 | .012 | .000 | .000 | .000 |
| | N | 26 | 26 | 25 | 26 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |
| Initiate | Correlation Coefficient | -.150 | -.001 | .023 | -.314 | .637** | .598** | .548** | .395** | 1.000 | .658** | .747** | .725** | .361** | .672** | .825** | .823** |
| | Sig. (2-tailed) | .466 | .996 | .912 | .118 | .000 | .000 | .000 | .001 | . | .000 | .000 | .000 | .002 | .000 | .000 | .000 |
| | N | 26 | 26 | 25 | 26 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Working Memory | Correlation Coefficient | .047 | -.120 | -.090 | -.215 | .680** | .744** | .432** | .560** | .658** | 1.000 | .768** | .748** | .406** | .693** | .859** | .840** |
| | Sig. (2-tailed) | .821 | .558 | .669 | .291 | .000 | .000 | .000 | .000 | .000 | . | .000 | .000 | .001 | .000 | .000 | .000 |
| | N | 26 | 26 | 25 | 26 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |
| Plan/ Organise | Correlation Coefficient | .156 | -.004 | -.110 | -.167 | .642** | .614** | .433** | .589** | .747** | .768** | 1.000 | .786** | .462** | .648** | .907** | .842** |
| | Sig. (2-tailed) | .445 | .983 | .602 | .414 | .000 | .000 | .000 | .000 | .000 | .000 | . | .000 | .000 | .000 | .000 | .000 |
| | N | 26 | 26 | 25 | 26 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |
| Task Monitor | Correlation Coefficient | -.084 | .039 | .070 | -.212 | .668** | .637** | .443** | .516** | .725** | .748** | .786** | 1.000 | .390** | .644** | .849** | .818** |
| | Sig. (2-tailed) | .682 | .848 | .739 | .298 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | . | .001 | .000 | .000 | .000 |
| | N | 26 | 26 | 25 | 26 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |
| Organisation of Materials | Correlation Coefficient | -.328 | .500** | .098 | -.108 | .363** | .114 | .183 | .302* | .361** | .406** | .462** | .390** | 1.000 | .262* | .643** | .491** |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sig. (2-tailed) | .102 | .009 | .640 | .599 | .002 | .353 | .135 | .012 | .002 | .001 | .000 | .001 | . | .030 | .000 | .000 |
| | N | 26 | 26 | 25 | 26 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |
| Behavioural Regulation Index | Correlation Coefficient | .111 | .027 | -.068 | -.152 | .889** | .747** | .858** | .709** | .672** | .693** | .648** | .644** | .262* | 1.000 | .696** | .914** |
| | Sig. (2-tailed) | .589 | .895 | .748 | .459 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .030 | . | .000 | .000 |
| | N | 26 | 26 | 25 | 26 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |
| Metacognition Index | Correlation Coefficient | -.044 | .076 | .066 | -.262 | .699** | .658** | .487** | .561** | .825** | .859** | .907** | .849** | .643** | .696** | 1.000 | .918** |
| | Sig. (2-tailed) | .831 | .711 | .754 | .195 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | . | .000 |
| | N | 26 | 26 | 25 | 26 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |
| Global Executive Composite | Correlation Coefficient | .024 | .057 | -.012 | -.243 | .866** | .752** | .726** | .678** | .823** | .840** | .842** | .818** | .491** | .914** | .918** | 1.000 |
| | Sig. (2-tailed) | .908 | .783 | .955 | .231 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | . |
| | N | 26 | 26 | 25 | 26 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |

### 6.2.3 Consideration of Co-variates

***BRIEF-A***

**Correlations**

| | | | Age | Gender | Had an Accident | Standard scores for the STAI-6 (Pre-test) | AQ_TotalLiK | Inhibit | Shift | Emotional Control | Self-Monitor | Initiate | Working Memory | Plan/Organise | Task Monitor | Organisation of Materials |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spearman's rho | Age | Correlation Coefficient | 1.000 | .227 | -.071 | .041 | -.077 | .047 | .119 | .007 | -.192 | .075 | .095 | .168 | .142 | .064 |
| | | Sig. (2-tailed) | . | .063 | .566 | .740 | .534 | .701 | .335 | .955 | .118 | .542 | .441 | .171 | .247 | .603 |
| | | N | 68 | 68 | 67 | 67 | 68 | 68 | 68 | 67 | 68 | 68 | 68 | 68 | 68 | 68 |
| | Gender | Correlation Coefficient | .227 | 1.000 | -.080 | .023 | .048 | .229 | .193 | -.062 | .190 | .153 | .191 | .125 | .093 | .003 |
| | | Sig. (2-tailed) | .063 | . | .517 | .854 | .695 | .059 | .112 | .613 | .118 | .208 | .117 | .307 | .445 | .983 |
| | | N | 68 | 71 | 68 | 68 | 69 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 |
| | Had an Accident | Correlation Coefficient | -.071 | -.080 | 1.000 | .078 | .077 | .159 | .036 | .304* | .019 | .065 | -.013 | -.069 | .094 | -.057 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sig. (2-tailed) | .566 | .517 | . | .530 | .531 | .196 | .774 | .012 | .876 | .601 | .918 | .576 | .446 | .643 |
| | N | 67 | 68 | 68 | 67 | 68 | 68 | 68 | 67 | 68 | 68 | 68 | 68 | 68 | 68 |
| Standard scores for the STAI-6 (Pre-test) | Correlation Coefficient | .041 | .023 | .078 | 1.000 | .262* | .256* | .122 | .281* | .187 | .350** | .206 | .232 | .285* | .109 |
| | Sig. (2-tailed) | .740 | .854 | .530 | . | .031 | .035 | .321 | .021 | .127 | .003 | .092 | .057 | .019 | .376 |
| | N | 67 | 68 | 67 | 68 | 68 | 68 | 68 | 67 | 68 | 68 | 68 | 68 | 68 | 68 |
| AQ_TotalLiK | Correlation Coefficient | -.077 | .048 | .077 | .262* | 1.000 | .408** | .462** | .221 | .356** | .279* | .399** | .399** | .307* | .073 |
| | Sig. (2-tailed) | .534 | .695 | .531 | .031 | . | .001 | .000 | .071 | .003 | .020 | .001 | .001 | .010 | .551 |
| | N | 68 | 69 | 68 | 68 | 69 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 |
| Inhibit | Correlation Coefficient | .047 | .229 | .159 | .256* | .408** | 1.000 | .579** | .656** | .725** | .637** | .680** | .642** | .668** | .363** |
| | Sig. (2-tailed) | .701 | .059 | .196 | .035 | .001 | . | .000 | .000 | .000 | .000 | .000 | .000 | .000 | .002 |
| | N | 68 | 69 | 68 | 68 | 69 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 |
| Shift | Correlation Coefficient | .119 | .193 | .036 | .122 | .462** | .579** | 1.000 | .502** | .429** | .598** | .744** | .614** | .637** | .114 |
| | Sig. (2-tailed) | .335 | .112 | .774 | .321 | .000 | .000 | . | .000 | .000 | .000 | .000 | .000 | .000 | .353 |
| | N | 68 | 69 | 68 | 68 | 69 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Emotional Control | Correlation Coefficient | .007 | -.062 | .304* | .281* | .221 | .656** | .502** | 1.000 | .421** | .548** | .432** | .433** | .443** | .183 |
| | Sig. (2-tailed) | .955 | .613 | .012 | .021 | .071 | .000 | .000 | . | .000 | .000 | .000 | .000 | .000 | .135 |
| | N | 67 | 68 | 67 | 67 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 |
| Self-Monitor | Correlation Coefficient | -.192 | .190 | .019 | .187 | .356** | .725** | .429** | .421** | 1.000 | .395** | .560** | .589** | .516** | .302* |
| | Sig. (2-tailed) | .118 | .118 | .876 | .127 | .003 | .000 | .000 | .000 | . | .001 | .000 | .000 | .000 | .012 |
| | N | 68 | 69 | 68 | 68 | 69 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 |
| Initiate | Correlation Coefficient | .075 | .153 | .065 | .350** | .279* | .637** | .598** | .548** | .395** | 1.000 | .658** | .747** | .725** | .361** |
| | Sig. (2-tailed) | .542 | .208 | .601 | .003 | .020 | .000 | .000 | .000 | .001 | . | .000 | .000 | .000 | .002 |
| | N | 68 | 69 | 68 | 68 | 69 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 |
| Working Memory | Correlation Coefficient | .095 | .191 | -.013 | .206 | .399** | .680** | .744** | .432** | .560** | .658** | 1.000 | .768** | .748** | .406** |
| | Sig. (2-tailed) | .441 | .117 | .918 | .092 | .001 | .000 | .000 | .000 | .000 | .000 | . | .000 | .000 | .001 |
| | N | 68 | 69 | 68 | 68 | 69 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 |
| Plan/Organise | Correlation Coefficient | .168 | .125 | -.069 | .232 | .399** | .642** | .614** | .433** | .589** | .747** | .768** | 1.000 | .786** | .462** |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sig. (2-tailed) | .171 | .307 | .576 | .057 | .001 | .000 | .000 | .000 | .000 | .000 | .000 | . | .000 | .000 |
| | | N | 68 | 69 | 68 | 68 | 69 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 |
| | Task Monitor | Correlation Coefficient | .142 | .093 | .094 | .285* | .307* | .668** | .637** | .443** | .516** | .725** | .748** | .786** | 1.000 | .390** |
| | | Sig. (2-tailed) | .247 | .445 | .446 | .019 | .010 | .000 | .000 | .000 | .000 | .000 | .000 | .000 | . | .001 |
| | | N | 68 | 69 | 68 | 68 | 69 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 |
| | Organisation of Materials | Correlation Coefficient | .064 | .003 | -.057 | .109 | .073 | .363** | .114 | .183 | .302* | .361** | .406** | .462** | .390** | 1.000 |
| | | Sig. (2-tailed) | .603 | .983 | .643 | .376 | .551 | .002 | .353 | .135 | .012 | .002 | .001 | .000 | .001 | . |
| | | N | 68 | 69 | 68 | 68 | 69 | 69 | 69 | 68 | 69 | 69 | 69 | 69 | 69 | 69 |

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

***DBQ***

**Correlations**

| | | | Age | Gender | Had an Accident | Standard scores for the STAI-6 (Pre-test) | AQ_TotalLiK | Absentminded | Close Encounters | Risky Driving | Dangerous Driving |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Spearman's rho | Age | Correlation Coefficient | 1.000 | .227 | -.071 | .041 | -.077 | -.180 | -.093 | -.185 | -.080 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sig. (2-tailed) | . | .063 | .566 | .740 | .534 | .151 | .467 | .144 | .528 |
| | | N | 68 | 68 | 67 | 67 | 68 | 65 | 64 | 64 | 64 |
| | Gender | Correlation Coefficient | .227 | 1.000 | -.080 | .023 | .048 | -.353** | -.102 | -.089 | -.047 |
| | | Sig. (2-tailed) | .063 | . | .517 | .854 | .695 | .004 | .417 | .486 | .710 |
| | | N | 68 | 71 | 68 | 68 | 69 | 66 | 65 | 64 | 65 |
| | Had an Accident | Correlation Coefficient | -.071 | -.080 | 1.000 | .078 | .077 | -.030 | .034 | -.170 | -.279* |
| | | Sig. (2-tailed) | .566 | .517 | . | .530 | .531 | .811 | .789 | .183 | .026 |
| | | N | 67 | 68 | 68 | 67 | 68 | 65 | 64 | 63 | 64 |
| | Standard scores for the STAI-6 (Pre-test) | Correlation Coefficient | .041 | .023 | .078 | 1.000 | .262* | -.170 | .154 | -.067 | -.296* |
| | | Sig. (2-tailed) | .740 | .854 | .530 | . | .031 | .177 | .225 | .601 | .017 |
| | | N | 67 | 68 | 67 | 68 | 68 | 65 | 64 | 63 | 64 |
| | AQ_Total LiK | Correlation Coefficient | -.077 | .048 | .077 | .262* | 1.000 | .042 | -.040 | .007 | .103 |
| | | Sig. (2-tailed) | .534 | .695 | .531 | .031 | . | .737 | .749 | .954 | .413 |
| | | N | 68 | 69 | 68 | 68 | 69 | 66 | 65 | 64 | 65 |
| | Absentminded | Correlation Coefficient | -.180 | -.353** | -.030 | -.170 | .042 | 1.000 | .588** | .380** | .459** |
| | | Sig. (2-tailed) | .151 | .004 | .811 | .177 | .737 | . | .000 | .002 | .000 |
| | | N | 65 | 66 | 65 | 65 | 66 | 66 | 65 | 64 | 65 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Close Encounters | Correlation Coefficient | -.093 | -.102 | .034 | .154 | -.040 | .588** | 1.000 | .418** | .348** |
| | | Sig. (2-tailed) | .467 | .417 | .789 | .225 | .749 | .000 | . | .001 | .005 |
| | | N | 64 | 65 | 64 | 64 | 65 | 65 | 65 | 63 | 65 |
| | Risky Driving | Correlation Coefficient | -.185 | -.089 | -.170 | -.067 | .007 | .380** | .418** | 1.000 | .557** |
| | | Sig. (2-tailed) | .144 | .486 | .183 | .601 | .954 | .002 | .001 | . | .000 |
| | | N | 64 | 64 | 63 | 63 | 64 | 64 | 63 | 64 | 63 |
| | Dangerous Driving | Correlation Coefficient | -.080 | -.047 | -.279* | -.296* | .103 | .459** | .348** | .557** | 1.000 |
| | | Sig. (2-tailed) | .528 | .710 | .026 | .017 | .413 | .000 | .005 | .000 | . |
| | | N | 64 | 65 | 64 | 64 | 65 | 65 | 65 | 63 | 65 |

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

***Neuropsychological Tests of EF***

**Correlations**

| | | | Age | Gender | Had an Accident | Standard scores for the STAI-6 (Pre-test) | AQ_Total LiK | Digit Span Task z-scores | Trail Making Task B-A | Stroop Task incong-cong | Double Letter Cancellation Test Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Spearman's rho | Age | Correlation Coefficient | 1.000 | .227 | -.071 | .041 | -.077 | .209 | .376 | -.031 | -.154 |
| | | Sig. (2-tailed) | . | .063 | .566 | .740 | .534 | .305 | .058 | .884 | .454 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | N | 68 | 68 | 67 | 67 | 68 | 26 | 26 | 25 | 26 |
| Gender | Correlation Coefficient | .227 | 1.000 | -.080 | .023 | .048 | -.093 | .331 | -.393 | -.309 |
| | Sig. (2-tailed) | .063 | . | .517 | .854 | .695 | .640 | .092 | .052 | .110 |
| | N | 68 | 71 | 68 | 68 | 69 | 28 | 27 | 25 | 28 |
| Had an Accident | Correlation Coefficient | -.071 | -.080 | 1.000 | .078 | .077 | .282 | .117 | .452* | .124 |
| | Sig. (2-tailed) | .566 | .517 | . | .530 | .531 | .172 | .578 | .027 | .555 |
| | N | 67 | 68 | 68 | 67 | 68 | 25 | 25 | 24 | 25 |
| Standard scores for the STAI-6 (Pre-test) | Correlation Coefficient | .041 | .023 | .078 | 1.000 | .262* | -.029 | -.047 | -.235 | .112 |
| | Sig. (2-tailed) | .740 | .854 | .530 | . | .031 | .887 | .820 | .257 | .586 |
| | N | 67 | 68 | 67 | 68 | 68 | 26 | 26 | 25 | 26 |
| AQ_Total LiK | Correlation Coefficient | -.077 | .048 | .077 | .262* | 1.000 | -.185 | -.098 | -.173 | -.387 |
| | Sig. (2-tailed) | .534 | .695 | .531 | .031 | . | .366 | .636 | .408 | .050 |
| | N | 68 | 69 | 68 | 68 | 69 | 26 | 26 | 25 | 26 |
| Digit Span Task z-scores | Correlation Coefficient | .209 | -.093 | .282 | -.029 | -.185 | 1.000 | -.001 | -.084 | .277 |
| | Sig. (2-tailed) | .305 | .640 | .172 | .887 | .366 | . | .996 | .689 | .154 |
| | N | 26 | 28 | 25 | 26 | 26 | 28 | 27 | 25 | 28 |
| Trail Making Task B-A | Correlation Coefficient | .376 | .331 | .117 | -.047 | -.098 | -.001 | 1.000 | -.288 | -.128 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sig. (2-tailed) | .058 | .092 | .578 | .820 | .636 | .996 | . | .163 | .524 |
| | N | 26 | 27 | 25 | 26 | 26 | 27 | 27 | 25 | 27 |
| Stroop Task incong-cong | Correlation Coefficient | -.031 | -.393 | .452* | -.235 | -.173 | -.084 | -.288 | 1.000 | .150 |
| | Sig. (2-tailed) | .884 | .052 | .027 | .257 | .408 | .689 | .163 | . | .474 |
| | N | 25 | 25 | 24 | 25 | 25 | 25 | 25 | 25 | 25 |
| Double Letter Cancellation Test Total | Correlation Coefficient | -.154 | -.309 | .124 | .112 | -.387 | .277 | -.128 | .150 | 1.000 |
| | Sig. (2-tailed) | .454 | .110 | .555 | .586 | .050 | .154 | .524 | .474 | . |
| | N | 26 | 28 | 25 | 26 | 26 | 28 | 27 | 25 | 28 |

*. Correlation is significant at the 0.05 level (2-tailed).

***Problematic Driving Outcomes***

**Correlations**

| | Age | Gender | Had an Accident | Standard scores for the STAI-6 (Pre-test) | AQ_TotalLiK | No of times did not signal | No of times went off of the road | No of times driving in opposite lane | No of times crossed solid white lines | No of times speed limit was broken | No of times getting into a traffic accident | No of times having an accident with a pedestrian | No of times did not yield to pedestrian crossing | No of times stopped on a pedestrian crossing | No of times right of way was violated | No of times running a red light |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spearman's rho | Age | Correlation Coefficient | 1.000 | .227 | -.071 | .041 | -.077 | .271 | -.140 | .248 | -.089 | -.482* | .115 | .059 | -.071 | .203 | -.077 | -.162 |
| | | Sig. (2-tailed) | . | .063 | .566 | .740 | .534 | .201 | .513 | .242 | .680 | .017 | .594 | .784 | .740 | .341 | .722 | .449 |
| | | N | 68 | 68 | 67 | 67 | 68 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| | Gender | Correlation Coefficient | .227 | 1.000 | -.080 | .023 | .048 | .000 | -.312 | .263 | -.160 | -.010 | .000 | -.143 | -.106 | .071 | .000 | -.287 |
| | | Sig. (2-tailed) | .063 | . | .517 | .854 | .695 | 1.000 | .138 | .215 | .455 | .964 | 1.000 | .505 | .621 | .743 | 1.000 | .174 |
| | | N | 68 | 71 | 68 | 68 | 69 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| | Had an Accident | Correlation Coefficient | -.071 | -.080 | 1.000 | .078 | .077 | -.114 | .330 | -.040 | .073 | -.233 | .111 | -.064 | -.159 | -.058 | .094 | -.078 |
| | | Sig. (2-tailed) | .566 | .517 | . | .530 | .531 | .605 | .124 | .857 | .740 | .285 | .613 | .772 | .469 | .791 | .669 | .724 |
| | | N | 67 | 68 | 68 | 67 | 68 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| | Standard scores for the STAI- | Correlation Coefficient | .041 | .023 | .078 | 1.000 | .262* | .014 | .065 | .275 | .151 | -.314 | .171 | .137 | .039 | -.290 | -.192 | .214 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 (Pre-test) | Sig. (2-tailed) | .740 | .854 | .530 | . | .031 | .949 | .761 | .193 | .481 | .135 | .425 | .523 | .858 | .169 | .370 | .315 |
| | N | 67 | 68 | 67 | 68 | 68 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| AQ_TotalLiK | Correlation Coefficient | -.077 | .048 | .077 | .262* | 1.000 | -.337 | -.104 | .006 | .201 | -.010 | -.152 | -.102 | .147 | -.185 | -.417* | -.071 |
| | Sig. (2-tailed) | .534 | .695 | .531 | .031 | . | .107 | .630 | .977 | .345 | .963 | .478 | .637 | .493 | .387 | .043 | .741 |
| | N | 68 | 69 | 68 | 68 | 69 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| No of times did not signal | Correlation Coefficient | .271 | .000 | -.114 | .014 | -.337 | 1.000 | .318 | .450* | .262 | -.077 | .310 | .427* | .110 | -.259 | .146 | .202 |
| | Sig. (2-tailed) | .201 | 1.000 | .605 | .949 | .107 | . | .130 | .027 | .216 | .722 | .140 | .037 | .609 | .221 | .496 | .345 |
| | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| No of times went off of the road | Correlation Coefficient | -.140 | -.312 | .330 | .065 | -.104 | .318 | 1.000 | .240 | .202 | -.108 | .350 | .468* | .240 | -.109 | .208 | .344 |
| | Sig. (2-tailed) | .513 | .138 | .124 | .761 | .630 | .130 | . | .259 | .344 | .617 | .094 | .021 | .258 | .612 | .330 | .100 |
| | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No of times driving in opposite lane | Correlation Coefficient | .248 | .263 | -.040 | .275 | .006 | .450* | .240 | 1.000 | .286 | -.275 | .013 | .312 | .387 | .036 | -.053 | .008 |
| | Sig. (2-tailed) | .242 | .215 | .857 | .193 | .977 | .027 | .259 | . | .176 | .194 | .951 | .138 | .062 | .867 | .806 | .972 |
| | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| No of times crossed solid white lines | Correlation Coefficient | -.089 | -.160 | .073 | .151 | .201 | .262 | .202 | .286 | 1.000 | -.089 | -.030 | .100 | .509* | -.105 | -.179 | .138 |
| | Sig. (2-tailed) | .680 | .455 | .740 | .481 | .345 | .216 | .344 | .176 | . | .679 | .891 | .642 | .011 | .624 | .402 | .520 |
| | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| No of times speed limit was broken | Correlation Coefficient | -.482* | -.010 | -.233 | -.314 | -.010 | -.077 | -.108 | -.275 | -.089 | 1.000 | .294 | -.029 | -.058 | -.216 | -.078 | .037 |
| | Sig. (2-tailed) | .017 | .964 | .285 | .135 | .963 | .722 | .617 | .194 | .679 | . | .163 | .892 | .789 | .311 | .718 | .864 |
| | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| No of times getting into a traffic | Correlation Coefficient | .115 | .000 | .111 | .171 | -.152 | .310 | .350 | .013 | -.030 | .294 | 1.000 | .116 | -.118 | -.242 | -.320 | .035 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| accident | Sig. (2-tailed) | .594 | 1.000 | .613 | .425 | .478 | .140 | .094 | .951 | .891 | .163 | . | .590 | .583 | .254 | .127 | .872 |
| | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| No of times having an accident with a pedestrian | Correlation Coefficient | .059 | -.143 | -.064 | .137 | -.102 | .427* | .468* | .312 | .100 | -.029 | .116 | 1.000 | .348 | -.020 | .173 | -.053 |
| | Sig. (2-tailed) | .784 | .505 | .772 | .523 | .637 | .037 | .021 | .138 | .642 | .892 | .590 | . | .096 | .925 | .419 | .805 |
| | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| No of times did not yield to pedestrian crossing | Correlation Coefficient | -.071 | -.106 | -.159 | .039 | .147 | .110 | .240 | .387 | .509* | -.058 | -.118 | .348 | 1.000 | .128 | -.181 | .177 |
| | Sig. (2-tailed) | .740 | .621 | .469 | .858 | .493 | .609 | .258 | .062 | .011 | .789 | .583 | .096 | . | .550 | .397 | .408 |
| | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| No of times stopped on a pedestrian crossing | Correlation Coefficient | .203 | .071 | -.058 | -.290 | -.185 | -.259 | -.109 | .036 | -.105 | -.216 | -.242 | -.020 | .128 | 1.000 | -.173 | -.303 |
| | Sig. (2-tailed) | .341 | .743 | .791 | .169 | .387 | .221 | .612 | .867 | .624 | .311 | .254 | .925 | .550 | . | .419 | .151 |
| | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No of times right of way was violated | Correlation Coefficient | -.077 | .000 | .094 | -.192 | -.417* | .146 | .208 | -.053 | -.179 | -.078 | -.320 | .173 | -.181 | -.173 | 1.000 | .363 |
| | | Sig. (2-tailed) | .722 | 1.000 | .669 | .370 | .043 | .496 | .330 | .806 | .402 | .718 | .127 | .419 | .397 | .419 | . | .081 |
| | | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| | No of times running a red light | Correlation Coefficient | -.162 | -.287 | -.078 | .214 | -.071 | .202 | .344 | .008 | .138 | .037 | .035 | -.053 | .177 | -.303 | .363 | 1.000 |
| | | Sig. (2-tailed) | .449 | .174 | .724 | .315 | .741 | .345 | .100 | .972 | .520 | .864 | .872 | .805 | .408 | .151 | .081 | . |
| | | N | 24 | 24 | 23 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |

*. Correlation is significant at the 0.05 level (2-tailed).

### 6.2.4 Partial Correlational Analysis

***BRIEF-A and DBQ factors***

**Correlations**

| Control Variables | | | Emotional Control | Dangerous Driving | Had an Accident | Standard scores for the STAI-6 (Pre-test) |
|---|---|---|---|---|---|---|
| -none-[a] | Emotional Control | Correlation | 1.000 | .107 | .302 | .299 |
| | | Significance (2-tailed) | . | .407 | .017 | .018 |
| | | df | 0 | 60 | 60 | 60 |
| | Dangerous Driving | Correlation | .107 | 1.000 | -.284 | -.244 |
| | | Significance (2-tailed) | .407 | . | .025 | .056 |
| | | df | 60 | 0 | 60 | 60 |
| | Had an Accident | Correlation | .302 | -.284 | 1.000 | .104 |
| | | Significance (2-tailed) | .017 | .025 | . | .422 |
| | | df | 60 | 60 | 0 | 60 |
| | Standard scores for the STAI-6 (Pre-test) | Correlation | .299 | -.244 | .104 | 1.000 |
| | | Significance (2-tailed) | .018 | .056 | .422 | . |
| | | df | 60 | 60 | 60 | 0 |
| Had an Accident & Standard scores for the STAI-6 (Pre-test) | Emotional Control | Correlation | 1.000 | .294 | | |
| | | Significance (2-tailed) | . | .023 | | |
| | | df | 0 | 58 | | |
| | Dangerous Driving | Correlation | .294 | 1.000 | | |
| | | Significance (2-tailed) | .023 | . | | |
| | | df | 58 | 0 | | |

a. Cells contain zero-order (Pearson) correlations.

**Correlations**

| Control Variables | | | Dangerous Driving | Inhibit | Initiate | Task Monitor | Behavioural Regulation Index | Global Executive Composite | Standard scores for the STAI-6 (Pre-test) |
|---|---|---|---|---|---|---|---|---|---|
| -none-[a] | Dangerous Driving | Correlation | 1.000 | .340 | .214 | .240 | .312 | .361 | -.256 |
| | | Significance (2-tailed) | . | .006 | .090 | .056 | .012 | .003 | .041 |
| | | df | 0 | 62 | 62 | 62 | 62 | 62 | 62 |
| | Inhibit | Correlation | .340 | 1.000 | .602 | .629 | .849 | .817 | .267 |
| | | Significance (2-tailed) | .006 | . | .000 | .000 | .000 | .000 | .033 |
| | | df | 62 | 0 | 62 | 62 | 62 | 62 | 62 |
| | Initiate | Correlation | .214 | .602 | 1.000 | .743 | .672 | .844 | .463 |
| | | Significance (2-tailed) | .090 | .000 | . | .000 | .000 | .000 | .000 |
| | | df | 62 | 62 | 0 | 62 | 62 | 62 | 62 |
| | Task Monitor | Correlation | .240 | .629 | .743 | 1.000 | .676 | .838 | .367 |
| | | Significance (2-tailed) | .056 | .000 | .000 | . | .000 | .000 | .003 |
| | | df | 62 | 62 | 62 | 0 | 62 | 62 | 62 |
| | Behavioural Regulation Index | Correlation | .312 | .849 | .672 | .676 | 1.000 | .908 | .278 |
| | | Significance (2-tailed) | .012 | .000 | .000 | .000 | . | .000 | .026 |
| | | df | 62 | 62 | 62 | 62 | 0 | 62 | 62 |
| | Global Executive Composite | Correlation | .361 | .817 | .844 | .838 | .908 | 1.000 | .363 |
| | | Significance (2-tailed) | .003 | .000 | .000 | .000 | .000 | . | .003 |
| | | df | 62 | 62 | 62 | 62 | 62 | 0 | 62 |
| | Standard scores for the STAI-6 (Pre-test) | Correlation | -.256 | .267 | .463 | .367 | .278 | .363 | 1.000 |
| | | Significance (2-tailed) | .041 | .033 | .000 | .003 | .026 | .003 | . |
| | | df | 62 | 62 | 62 | 62 | 62 | 62 | 0 |
| Standard scores for the STAI-6 | Dangerous Driving | Correlation | 1.000 | .439 | .388 | .371 | .413 | .503 | |
| | | Significance (2-tailed) | . | .000 | .002 | .003 | .001 | .000 | |
| | | df | 0 | 61 | 61 | 61 | 61 | 61 | |
| | Inhibit | Correlation | .439 | 1.000 | .560 | .593 | .837 | .802 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (Pre-test) | | Significance (2-tailed) | .000 | . | .000 | .000 | .000 | .000 | |
| | | df | 61 | 0 | 61 | 61 | 61 | 61 | |
| | Initiate | Correlation | .388 | .560 | 1.000 | .694 | .638 | .819 | |
| | | Significance (2-tailed) | .002 | .000 | . | .000 | .000 | .000 | |
| | | df | 61 | 61 | 0 | 61 | 61 | 61 | |
| | Task Monitor | Correlation | .371 | .593 | .694 | 1.000 | .642 | .813 | |
| | | Significance (2-tailed) | .003 | .000 | .000 | . | .000 | .000 | |
| | | df | 61 | 61 | 61 | 0 | 61 | 61 | |
| | Behavioural Regulation Index | Correlation | .413 | .837 | .638 | .642 | 1.000 | .901 | |
| | | Significance (2-tailed) | .001 | .000 | .000 | .000 | . | .000 | |
| | | df | 61 | 61 | 61 | 61 | 0 | 61 | |
| | Global Executive Composite | Correlation | .503 | .802 | .819 | .813 | .901 | 1.000 | |
| | | Significance (2-tailed) | .000 | .000 | .000 | .000 | .000 | . | |
| | | df | 61 | 61 | 61 | 61 | 61 | 0 | |

a. Cells contain zero-order (Pearson) correlations.

### 6.2.5 BRIEF-A and DBQ Regression Analysis

***BRIEF-A Subscales and Absentminded Factor***

**Variables Entered/Removed[a]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | Organisation of Materials, Gender, Had an Accident, AQ_TotalLiK, Standard scores for the STAI-6 (Pre-test), Emotional Control, Self-Monitor, Task Monitor, Shift, Inhibit, Initiate, Working Memory, Plan/Organise[b] | . | Enter |

a. Dependent Variable: Absentminded

b. All requested variables entered.

**Model Summary[b]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .606[a] | .368 | .200 | 9.45741 |

a. Predictors: (Constant), Organisation of Materials, Gender, Had an Accident, AQ_TotalLiK, Standard scores for the STAI-6 (Pre-test), Emotional Control, Self-Monitor, Task Monitor, Shift, Inhibit, Initiate, Working Memory, Plan/Organise

b. Dependent Variable: Absentminded

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 2550.174 | 13 | 196.167 | 2.193 | .024[b] |
| | Residual | 4382.683 | 49 | 89.443 | | |
| | Total | 6932.857 | 62 | | | |

a. Dependent Variable: Absentminded

b. Predictors: (Constant), Organisation of Materials, Gender, Had an Accident, AQ_TotalLiK, Standard scores for the STAI-6 (Pre-test), Emotional Control, Self-Monitor, Task Monitor, Shift, Inhibit, Initiate, Working Memory, Plan/Organise

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | 48.250 | 11.455 | | 4.212 | .000 | 25.231 | 71.269 |
| | Gender | -9.626 | 3.345 | -.371 | -2.878 | .006 | -16.348 | -2.904 |
| | Had an Accident | -2.045 | 3.277 | -.083 | -.624 | .536 | -8.630 | 4.540 |
| | Standard scores for the STAI-6 (Pre-test) | -.172 | .151 | -.162 | -1.140 | .260 | -.474 | .131 |
| | AQ_TotalLiK | -.839 | .497 | -.235 | -1.690 | .097 | -1.837 | .159 |
| | Inhibit | .118 | .168 | .147 | .701 | .486 | -.219 | .455 |
| | Shift | .079 | .168 | .096 | .472 | .639 | -.258 | .416 |
| | Emotional Control | .097 | .157 | .112 | .617 | .540 | -.218 | .411 |
| | Self-Monitor | -.052 | .148 | -.061 | -.350 | .728 | -.350 | .246 |
| | Initiate | -.035 | .212 | -.038 | -.163 | .871 | -.460 | .391 |
| | Working Memory | .452 | .200 | .518 | 2.254 | .029 | .049 | .855 |
| | Plan/Organise | .036 | .241 | .038 | .151 | .881 | -.449 | .522 |
| | Task Monitor | -.237 | .214 | -.251 | -1.107 | .274 | -.667 | .193 |
| | Organisation of Materials | .045 | .136 | .049 | .328 | .744 | -.228 | .317 |

a. Dependent Variable: Absentminded

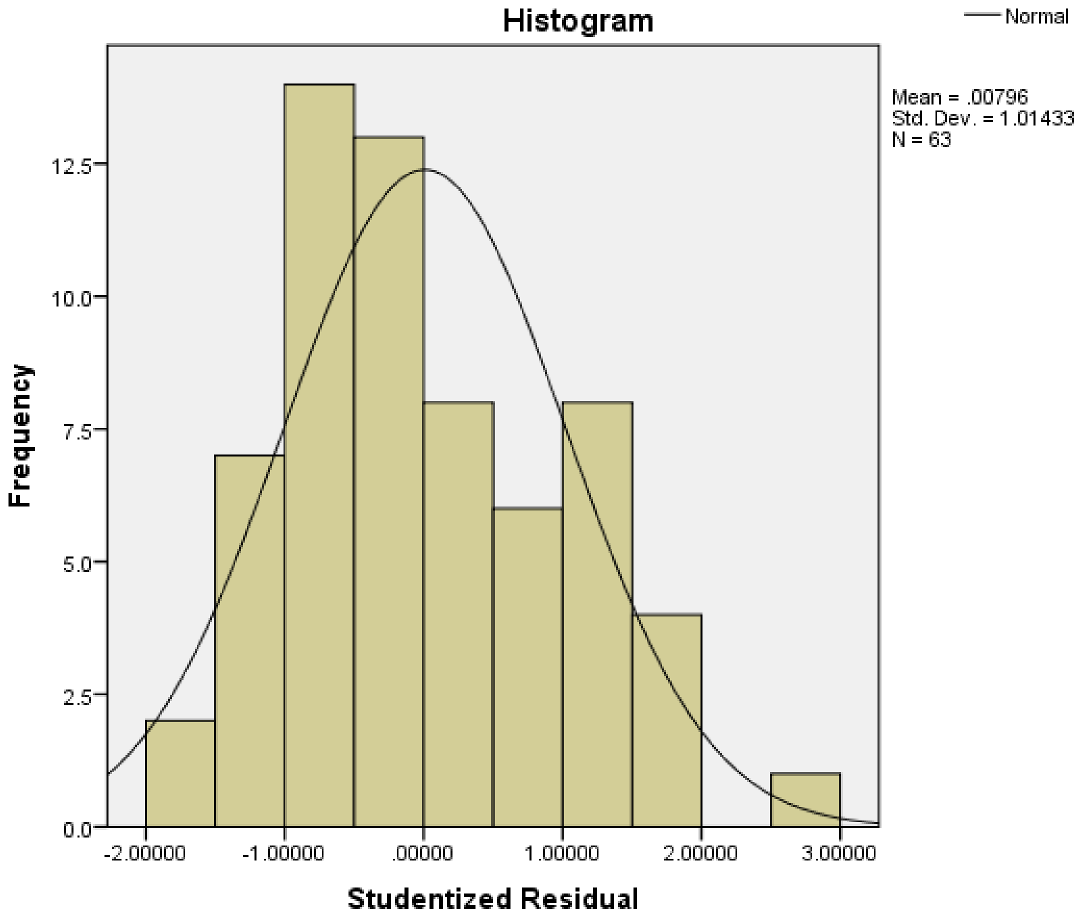
**Descriptives**

| | | | Statistic | Std. Error |
|---|---|---|---|---|
| Studentized Residual | Mean | | .0079599 | .12779308 |
| | 95% Confidence Interval for Mean | Lower Bound | -.2474949 | |
| | | Upper Bound | .2634146 | |
| | 5% Trimmed Mean | | -.0239673 | |
| | Median | | -.2600792 | |
| | Variance | | 1.029 | |
| | Std. Deviation | | 1.01432613 | |
| | Minimum | | -1.77833 | |
| | Maximum | | 2.73904 | |
| | Range | | 4.51737 | |
| | Interquartile Range | | 1.66388 | |
| | Skewness | | .520 | .302 |
| | Kurtosis | | -.443 | .595 |

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| Studentized Residual | .124 | 63 | .017 | .962 | 63 | .048 |

a. Lilliefors Significance Correction




**Variables Entered/Removed[a]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | Organisation of Materials, Gender, AQ_TotalLiK, Emotional Control, Self-Monitor, Task Monitor, Shift, Initiate, Inhibit, Working Memory, Plan/Organise[b] | . | Enter |

a. Dependent Variable: Absentminded

b. All requested variables entered.

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .602[a] | .363 | .231 | 9.33895 |

a. Predictors: (Constant), Organisation of Materials, Gender, AQ_TotalLiK, Emotional Control, Self-Monitor, Task Monitor, Shift, Initiate, Inhibit, Working Memory, Plan/Organise

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 2632.538 | 11 | 239.322 | 2.744 | .007[b] |
| | Residual | 4622.446 | 53 | 87.216 | | |
| | Total | 7254.985 | 64 | | | |

a. Dependent Variable: Absentminded

b. Predictors: (Constant), Organisation of Materials, Gender, AQ_TotalLiK, Emotional Control, Self-Monitor, Task Monitor, Shift, Initiate, Inhibit, Working Memory, Plan/Organise

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| 1 | (Constant) | 41.948 | 10.333 | | 4.060 | .000 | 21.222 | 62.674 |
| | Gender | -11.004 | 3.160 | -.428 | -3.482 | .001 | -17.342 | -4.666 |
| | AQ_TotalLiK | -1.026 | .457 | -.284 | -2.244 | .029 | -1.943 | -.109 |
| | Inhibit | .103 | .164 | .125 | .627 | .533 | -.225 | .431 |
| | Shift | .153 | .157 | .184 | .977 | .333 | -.161 | .468 |
| | Emotional Control | .053 | .142 | .062 | .371 | .712 | -.233 | .338 |
| | Self-Monitor | -.027 | .145 | -.031 | -.184 | .855 | -.318 | .265 |
| | Initiate | -.088 | .197 | -.094 | -.445 | .658 | -.484 | .308 |
| | Working Memory | .441 | .195 | .499 | 2.266 | .028 | .051 | .832 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Plan/Organise | .085 | .226 | .086 | .375 | .709 | -.369 | .539 |
| Task Monitor | -.286 | .198 | -.302 | -1.441 | .155 | -.683 | .112 |
| Organisation of Materials | .057 | .133 | .061 | .426 | .672 | -.210 | .323 |

a. Dependent Variable: Absentminded

**Bootstrap for Coefficients**

| Model | B | Bootstrap[a] Bias | Std. Error | Sig. (2-tailed) | BCa 95% Confidence Interval Lower | Upper |
|---|---|---|---|---|---|---|
| 1 (Constant) | 41.948 | -2.277 | 11.461 | .002 | 20.694 | 57.436 |
| Gender | -11.004 | .376 | 3.216 | .001 | -17.986 | -3.395 |
| AQ_TotalLiK | -1.026 | .116 | .560 | .069 | -2.041 | .532 |
| Inhibit | .103 | .001 | .211 | .541 | -.339 | .603 |
| Shift | .153 | -.026 | .181 | .390 | -.169 | .416 |
| Emotional Control | .053 | .003 | .149 | .711 | -.251 | .368 |
| Self-Monitor | -.027 | -.009 | .173 | .870 | -.333 | .277 |
| Initiate | -.088 | -.002 | .206 | .671 | -.489 | .306 |
| Working Memory | .441 | .026 | .223 | .050 | .019 | .977 |
| Plan/Organise | .085 | .029 | .260 | .739 | -.401 | .708 |
| Task Monitor | -.286 | -.017 | .224 | .198 | -.733 | .083 |
| Organisation of Materials | .057 | -.020 | .141 | .672 | -.201 | .258 |

a. Unless otherwise noted, bootstrap results are based on 10000 bootstrap samples

**Descriptives**

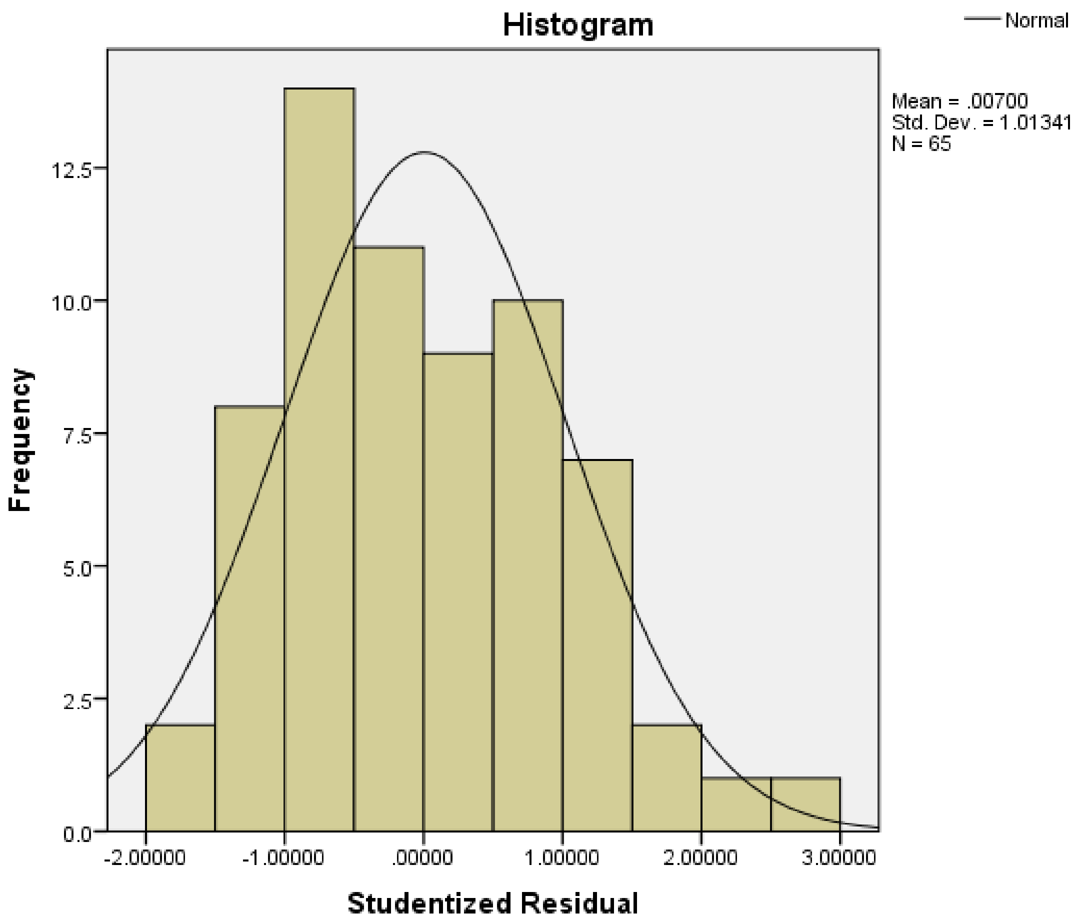
| | | | Statistic | Std. Error |
|---|---|---|---|---|
| Studentized Residual | Mean | | .0070034 | .12569796 |
| | 95% Confidence Interval for Mean | Lower Bound | -.2441072 | |
| | | Upper Bound | .2581139 | |
| | 5% Trimmed Mean | | -.0236736 | |
| | Median | | -.1509210 | |
| | Variance | | 1.027 | |
| | Std. Deviation | | 1.01340933 | |
| | Minimum | | -1.98665 | |
| | Maximum | | 2.94828 | |
| | Range | | 4.93493 | |
| | Interquartile Range | | 1.64340 | |
| | Skewness | | .462 | .297 |
| | Kurtosis | | -.161 | .586 |

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| Studentized Residual | .081 | 65 | .200* | .976 | 65 | .235 |

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction




***BRIEF-A Subscales and Close Call Factor***

**Variables Entered/Removed[a]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | Organisation of Materials, Gender, Had an Accident, AQ_TotalLiK, Standard scores for the STAI-6 (Pre-test), Emotional Control, Self-Monitor, Task Monitor, Shift, Inhibit, Initiate, Working Memory, Plan/Organise[b] | . | Enter |

a. Dependent Variable: Close Encounters

b. All requested variables entered.

**Model Summary[b]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .496[a] | .246 | .041 | 4.92171 |

a. Predictors: (Constant), Organisation of Materials, Gender, Had an Accident, AQ_TotalLiK, Standard scores for the STAI-6 (Pre-test), Emotional Control, Self-Monitor, Task Monitor, Shift, Inhibit, Initiate, Working Memory, Plan/Organise

b. Dependent Variable: Close Encounters

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 378.704 | 13 | 29.131 | 1.203 | .307[b] |
| | Residual | 1162.715 | 48 | 24.223 | | |
| | Total | 1541.419 | 61 | | | |

a. Dependent Variable: Close Encounters

b. Predictors: (Constant), Organisation of Materials, Gender, Had an Accident, AQ_TotalLiK, Standard scores for the STAI-6 (Pre-test), Emotional Control, Self-Monitor, Task Monitor, Shift, Inhibit, Initiate, Working Memory, Plan/Organise

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | 95... Lo... |
|---|---|---|---|---|---|---|---|
| 1 | (Constant) | 13.095 | 5.993 | | 2.185 | .034 | |
| | Gender | -1.672 | 1.741 | -.136 | -.960 | .342 | |
| | Had an Accident | -.540 | 1.710 | -.046 | -.316 | .753 | |
| | Standard scores for the STAI-6 (Pre-test) | .043 | .078 | .086 | .550 | .585 | |
| | AQ_TotalLiK | -.598 | .262 | -.350 | -2.283 | .027 | |
| | Inhibit | -.043 | .088 | -.111 | -.486 | .629 | |
| | Shift | .076 | .089 | .196 | .861 | .394 | |
| | Emotional Control | .068 | .082 | .168 | .839 | .406 | |
| | Self-Monitor | .085 | .077 | .209 | 1.100 | .277 | |
| | Initiate | -.088 | .112 | -.198 | -.784 | .437 | |
| | Working Memory | .091 | .105 | .220 | .873 | .387 | |
| | Plan/Organise | -.035 | .126 | -.076 | -.279 | .782 | |
| | Task Monitor | .074 | .111 | .165 | .660 | .512 | |
| | Organisation of Materials | .037 | .071 | .086 | .517 | .608 | |

a. Dependent Variable: Close Encounters

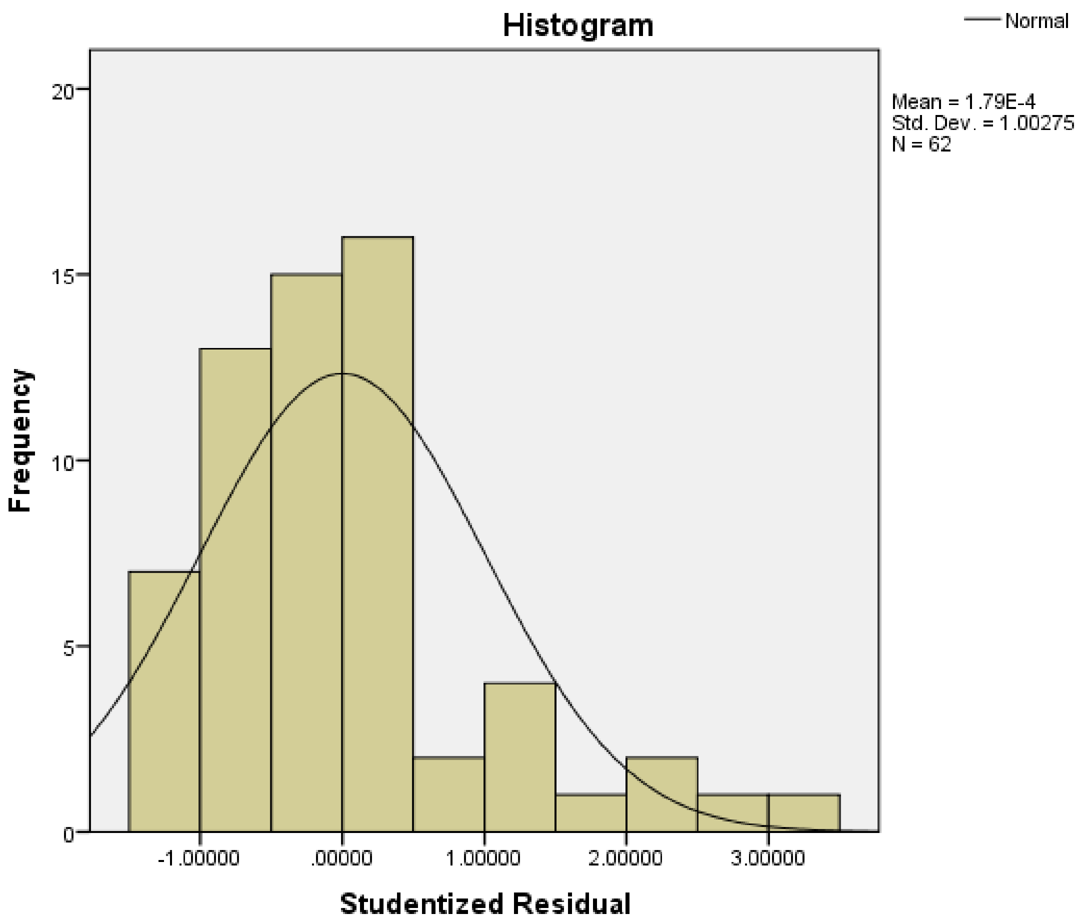
**Descriptives**

| | | | Statistic | Std. Error |
|---|---|---|---|---|
| Studentized Residual | Mean | | .0001792 | .12734929 |
| | 95% Confidence Interval for Mean | Lower Bound | -.2544714 | |
| | | Upper Bound | .2548299 | |
| | 5% Trimmed Mean | | -.0788820 | |
| | Median | | -.1646164 | |
| | Variance | | 1.006 | |
| | Std. Deviation | | 1.00274932 | |
| | Minimum | | -1.49616 | |
| | Maximum | | 3.41810 | |
| | Range | | 4.91426 | |
| | Interquartile Range | | .97948 | |
| | Skewness | | 1.342 | .304 |
| | Kurtosis | | 2.111 | .599 |

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| Studentized Residual | .156 | 62 | .001 | .894 | 62 | .000 |

a. Lilliefors Significance Correction




***BRIEF-A Subscales and Risky Driving Factor***

**Variables Entered/Removed[a]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | Organisation of Materials, Gender, Had an Accident, AQ_TotalLiK, Standard scores for the STAI-6 (Pre-test), Self-Monitor, Shift, Emotional Control, Task Monitor, Inhibit, Initiate, Working Memory, Plan/Organise[b] | . | Enter |

a. Dependent Variable: Risky Driving

b. All requested variables entered.

**Model Summary[b]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .610[a] | .372 | .198 | 5.23024 |

a. Predictors: (Constant), Organisation of Materials, Gender, Had an Accident, AQ_TotalLiK, Standard scores for the STAI-6 (Pre-test), Self-Monitor, Shift, Emotional Control, Task Monitor, Inhibit, Initiate, Working Memory, Plan/Organise

b. Dependent Variable: Risky Driving

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 761.446 | 13 | 58.573 | 2.141 | .029[b] |
| | Residual | 1285.702 | 47 | 27.355 | | |
| | Total | 2047.148 | 60 | | | |

a. Dependent Variable: Risky Driving

b. Predictors: (Constant), Organisation of Materials, Gender, Had an Accident, AQ_TotalLiK, Standard scores for the STAI-6 (Pre-test), Self-Monitor, Shift, Emotional Control, Task Monitor, Inhibit, Initiate, Working Memory, Plan/Organise

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | 95... Lo... |
|---|---|---|---|---|---|---|---|
| 1 | (Constant) | 17.635 | 6.425 | | 2.745 | .009 | |
| | Gender | -.366 | 1.878 | -.025 | -.195 | .846 | |
| | Had an Accident | -1.860 | 1.869 | -.135 | -.995 | .325 | |
| | Standard scores for the STAI-6 (Pre-test) | -.180 | .083 | -.310 | -2.153 | .037 | |
| | AQ_TotalLiK | -.209 | .292 | -.102 | -.717 | .477 | |
| | Inhibit | -.012 | .094 | -.028 | -.133 | .895 | |
| | Shift | .005 | .093 | .011 | .054 | .957 | |
| | Emotional Control | .036 | .089 | .076 | .405 | .688 | |
| | Self-Monitor | .168 | .083 | .356 | 2.037 | .047 | |
| | Initiate | .151 | .120 | .293 | 1.260 | .214 | |
| | Working Memory | -.187 | .112 | -.387 | -1.676 | .100 | |
| | Plan/Organise | .029 | .138 | .054 | .214 | .831 | |
| | Task Monitor | -.026 | .120 | -.049 | -.213 | .832 | |
| | Organisation of Materials | .188 | .076 | .376 | 2.457 | .018 | |

a. Dependent Variable: Risky Driving

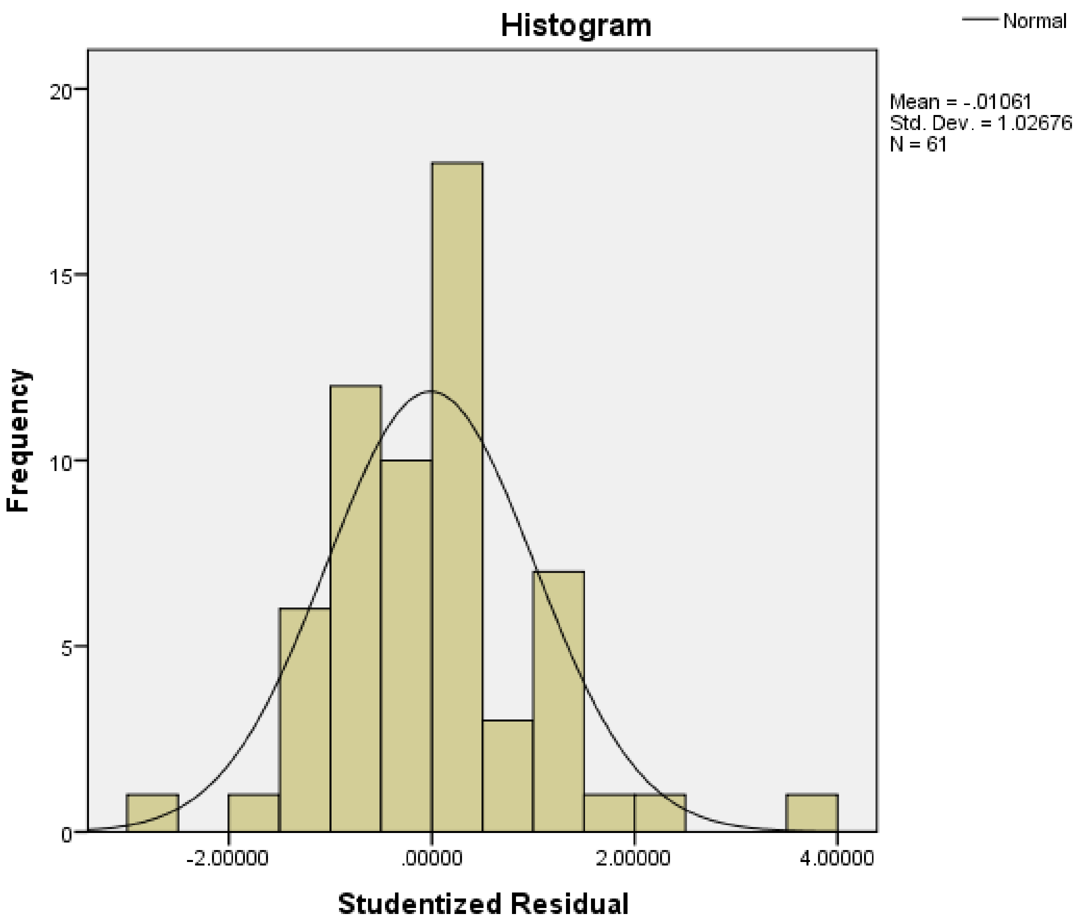
**Descriptives**

| | | | Statistic | Std. Error |
|---|---|---|---|---|
| Studentized Residual | Mean | | -.0106074 | .13146286 |
| | 95% Confidence Interval for Mean | Lower Bound | -.2735723 | |
| | | Upper Bound | .2523575 | |
| | 5% Trimmed Mean | | -.0419667 | |
| | Median | | .0203263 | |
| | Variance | | 1.054 | |
| | Std. Deviation | | 1.02675775 | |
| | Minimum | | -2.62155 | |
| | Maximum | | 3.52985 | |
| | Range | | 6.15140 | |
| | Interquartile Range | | 1.07749 | |
| | Skewness | | .608 | .306 |
| | Kurtosis | | 1.615 | .604 |

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| Studentized Residual | .108 | 61 | .076 | .969 | 61 | .122 |

a. Lilliefors Significance Correction




**Variables Entered/Removed[a]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | Organisation of Materials, Shift, Standard scores for the STAI-6 (Pre-test), Self-Monitor, Emotional Control, Task Monitor, Inhibit, Initiate, Working Memory, Plan/Organise[b] | . | Enter |

a. Dependent Variable: Risky Driving

b. All requested variables entered.

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .587[a] | .345 | .216 | 5.18028 |

a. Predictors: (Constant), Organisation of Materials, Shift, Standard scores for the STAI-6 (Pre-test), Self-Monitor, Emotional Control, Task Monitor, Inhibit, Initiate, Working Memory, Plan/Organise

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 719.591 | 10 | 71.959 | 2.682 | .010[b] |
| | Residual | 1368.602 | 51 | 26.835 | | |
| | Total | 2088.194 | 61 | | | |

a. Dependent Variable: Risky Driving

b. Predictors: (Constant), Organisation of Materials, Shift, Standard scores for the STAI-6 (Pre-test), Self-Monitor, Emotional Control, Task Monitor, Inhibit, Initiate, Working Memory, Plan/Organise

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | | 95 |
|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. | Lo |
| 1 | (Constant) | 11.703 | 4.890 | | 2.393 | .020 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Standard scores for the STAI-6 (Pre-test) | -.205 | .078 | -.350 | -2.622 | .012 |
| | Inhibit | -.035 | .090 | -.077 | -.385 | .702 |
| | Shift | -.014 | .086 | -.030 | -.158 | .875 |
| | Emotional Control | .027 | .080 | .056 | .330 | .743 |
| | Self-Monitor | .161 | .080 | .338 | 2.003 | .050 |
| | Initiate | .165 | .117 | .318 | 1.407 | .166 |
| | Working Memory | -.189 | .110 | -.389 | -1.708 | .094 |
| | Plan/Organise | .069 | .129 | .127 | .537 | .594 |
| | Task Monitor | -.031 | .111 | -.060 | -.283 | .778 |
| | Organisation of Materials | .186 | .075 | .369 | 2.484 | .016 |

a. Dependent Variable: Risky Driving

**Bootstrap for Coefficients**

| Model | | B | Bootstrap[a] | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | BCa 95% Confidence In | |
| | | | Bias | Std. Error | Sig. (2-tailed) | Lower | Up |
| 1 | (Constant) | 11.703 | -.821 | 5.382 | .041 | 1.155 | |
| | Standard scores for the STAI-6 (Pre-test) | -.205 | .008 | .100 | .061 | -.439 | |
| | Inhibit | -.035 | -.020 | .137 | .768 | -.384 | |
| | Shift | -.014 | .006 | .090 | .876 | -.196 | |
| | Emotional Control | .027 | .006 | .098 | .786 | -.173 | |
| | Self-Monitor | .161 | .006 | .097 | .097 | .012 | |
| | Initiate | .165 | .009 | .105 | .131 | -.029 | |
| | Working Memory | -.189 | .001 | .097 | .057 | -.384 | |
| | Plan/Organise | .069 | .005 | .168 | .692 | -.223 | |
| | Task Monitor | -.031 | -.012 | .143 | .827 | -.330 | |
| | Organisation of Materials | .186 | .009 | .075 | .018 | -.003 | |

a. Unless otherwise noted, bootstrap results are based on 10000 bootstrap samples

**Descriptives**

| | | | Statistic | Std. Error |
|---|---|---|---|---|
| Studentized Residual | Mean | | -.0088170 | .13063646 |
| | 95% Confidence Interval for Mean | Lower Bound | -.2700407 | |
| | | Upper Bound | .2524068 | |

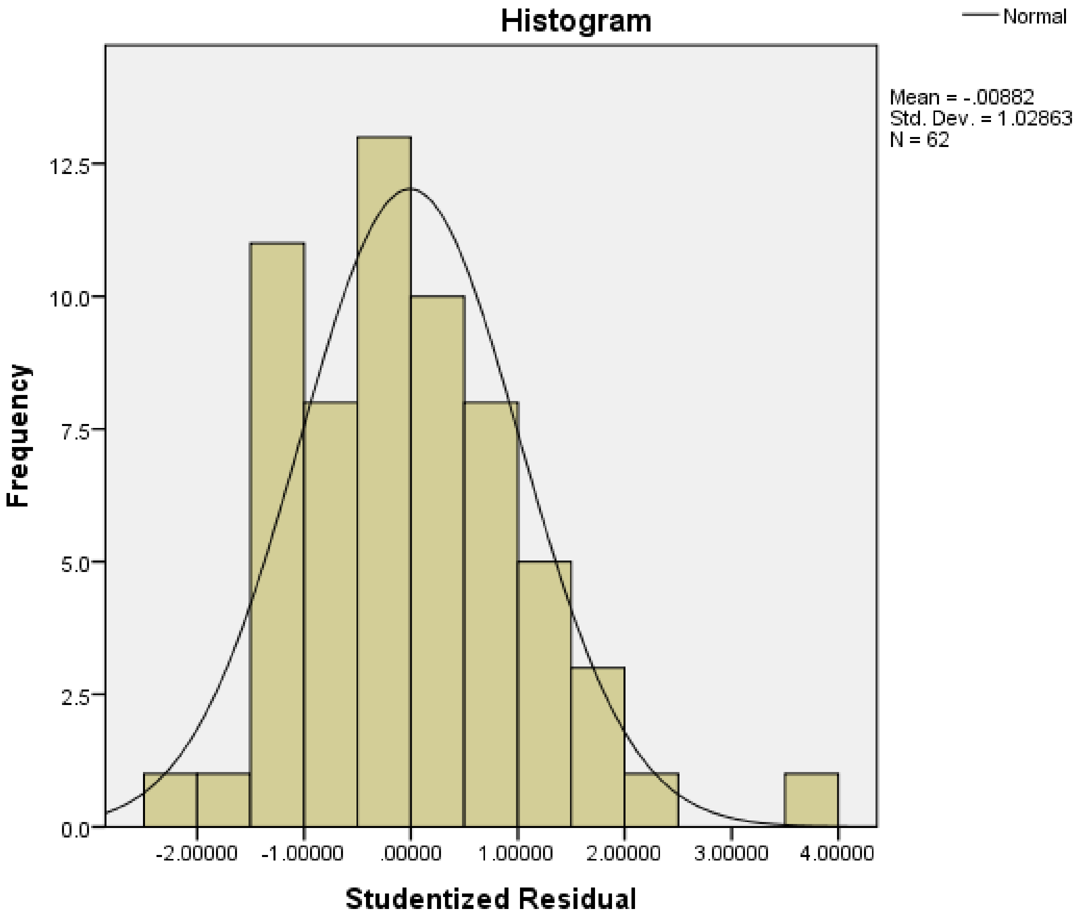
| | | | |
|---|---|---|---|
| | 5% Trimmed Mean | -.0456034 | |
| | Median | -.0960949 | |
| | Variance | 1.058 | |
| | Std. Deviation | 1.02863253 | |
| | Minimum | -2.49383 | |
| | Maximum | 3.73023 | |
| | Range | 6.22406 | |
| | Interquartile Range | 1.35541 | |
| | Skewness | .718 | .304 |
| | Kurtosis | 1.831 | .599 |

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| Studentized Residual | .068 | 62 | .200* | .965 | 62 | .076 |

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction




***BRIEF-A Subscales and Dangerous Driving Factor***

**Variables Entered/Removed[a]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | Organisation of Materials, Gender, Had an Accident, AQ_TotalLiK, Standard scores for the STAI-6 (Pre-test), Emotional Control, Self-Monitor, Task Monitor, Shift, Inhibit, Initiate, Working Memory, Plan/Organise[b] | . | Enter |

a. Dependent Variable: Dangerous Driving

b. All requested variables entered.

**Model Summary[b]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .770[a] | .593 | .483 | 4.18879 |

a. Predictors: (Constant), Organisation of Materials, Gender, Had an Accident, AQ_TotalLiK, Standard scores for the STAI-6 (Pre-test), Emotional Control, Self-Monitor, Task Monitor, Shift, Inhibit, Initiate, Working Memory, Plan/Organise

b. Dependent Variable: Dangerous Driving

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 1227.034 | 13 | 94.387 | 5.379 | .000[b] |
| | Residual | 842.207 | 48 | 17.546 | | |
| | Total | 2069.242 | 61 | | | |

a. Dependent Variable: Dangerous Driving

b. Predictors: (Constant), Organisation of Materials, Gender, Had an Accident, AQ_TotalLiK, Standard scores for the STAI-6 (Pre-test), Emotional Control, Self-Monitor, Task Monitor, Shift, Inhibit, Initiate, Working Memory, Plan/Organise

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | 95 Lo |
|---|---|---|---|---|---|---|---|
| 1 | (Constant) | 21.622 | 5.101 | | 4.239 | .000 | |
| | Gender | -2.323 | 1.482 | -.164 | -1.568 | .123 | |
| | Had an Accident | -2.753 | 1.455 | -.204 | -1.892 | .065 | |
| | Standard scores for the STAI-6 (Pre-test) | -.152 | .067 | -.261 | -2.273 | .028 | |
| | AQ_TotalLiK | -.600 | .223 | -.303 | -2.693 | .010 | |
| | Inhibit | .123 | .075 | .277 | 1.652 | .105 | |
| | Shift | .186 | .075 | .412 | 2.463 | .017 | |
| | Emotional Control | -.067 | .069 | -.142 | -.968 | .338 | |
| | Self-Monitor | .166 | .066 | .352 | 2.529 | .015 | |
| | Initiate | .011 | .095 | .021 | .114 | .910 | |
| | Working Memory | -.230 | .089 | -.476 | -2.578 | .013 | |
| | Plan/Organise | .020 | .107 | .037 | .186 | .853 | |
| | Task Monitor | .027 | .095 | .052 | .286 | .776 | |
| | Organisation of Materials | .221 | .061 | .444 | 3.636 | .001 | |

a. Dependent Variable: Dangerous Driving

**Descriptives**

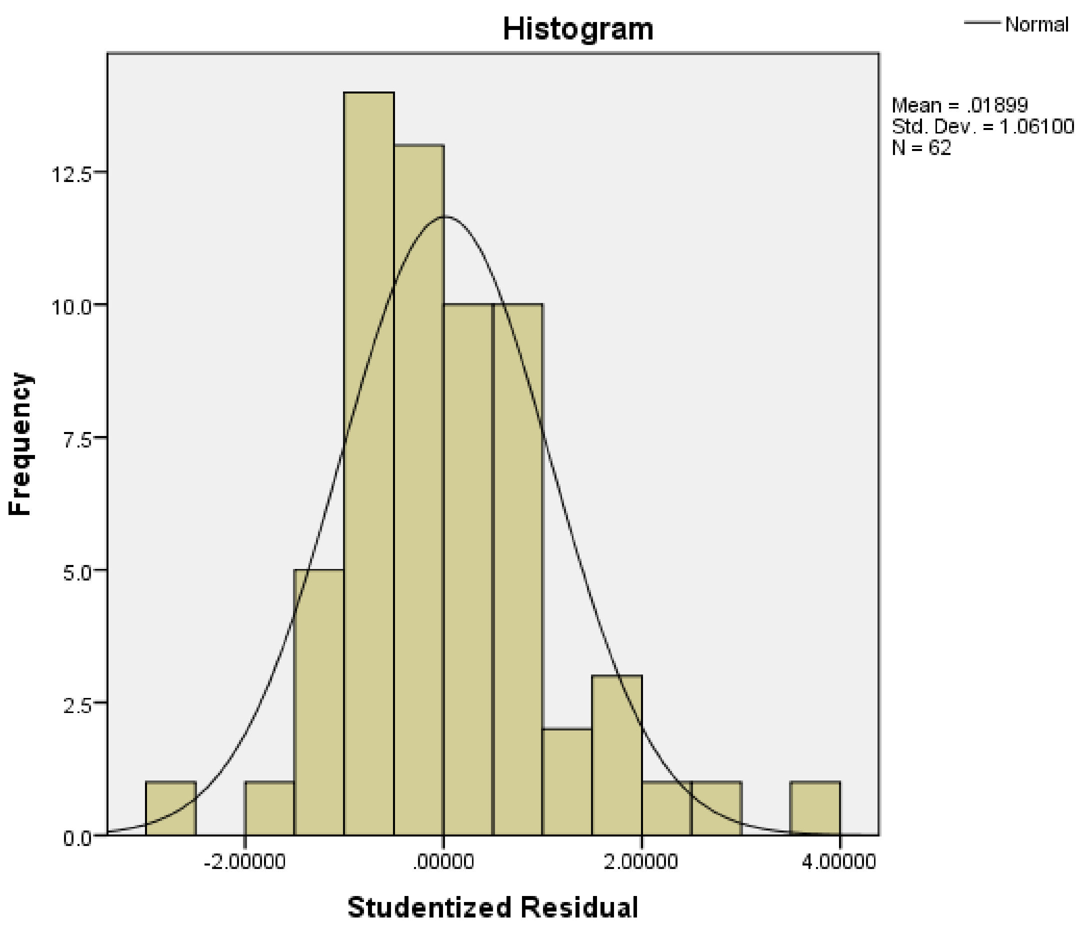
| | | | Statistic | Std. Error |
|---|---|---|---|---|
| Studentized Residual | Mean | | .0189874 | .13474709 |
| | 95% Confidence Interval for Mean | Lower Bound | -.2504561 | |
| | | Upper Bound | .2884308 | |
| | 5% Trimmed Mean | | -.0314678 | |
| | Median | | -.0940213 | |
| | Variance | | 1.126 | |
| | Std. Deviation | | 1.06099966 | |
| | Minimum | | -2.66905 | |
| | Maximum | | 3.73936 | |
| | Range | | 6.40841 | |
| | Interquartile Range | | 1.26969 | |
| | Skewness | | .797 | .304 |
| | Kurtosis | | 2.022 | .599 |

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| Studentized Residual | .095 | 62 | .200* | .956 | 62 | .027 |

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction




**Variables Entered/Removed[a]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | Organisation of Materials, Shift, Standard scores for the STAI-6 (Pre-test), AQ_TotalLiK, Self-Monitor, Emotional Control, Task Monitor, Inhibit, Initiate, Working Memory, Plan/Organise[b] | . | Enter |

a. Dependent Variable: Dangerous Driving

b. All requested variables entered.

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .732[a] | .536 | .436 | 4.36001 |

a. Predictors: (Constant), Organisation of Materials, Shift, Standard scores for the STAI-6 (Pre-test), AQ_TotalLiK, Self-Monitor, Emotional Control, Task Monitor, Inhibit, Initiate, Working Memory, Plan/Organise

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 1120.254 | 11 | 101.841 | 5.357 | .000[b] |
| | Residual | 969.492 | 51 | 19.010 | | |
| | Total | 2089.746 | 62 | | | |

a. Dependent Variable: Dangerous Driving

b. Predictors: (Constant), Organisation of Materials, Shift, Standard scores for the STAI-6 (Pre-test), AQ_TotalLiK, Self-Monitor, Emotional Control, Task Monitor, Inhibit, Initiate, Working Memory, Plan/Organise

**Coefficients[a]**

| Model | Unstandardized Coefficients | Standardized Coefficients | t | Sig. | 95 |
|---|---|---|---|---|---|

| | | B | Std. Error | Beta | | | Lo |
|---|---|---|---|---|---|---|---|
| 1 | (Constant) | 15.415 | 4.735 | | 3.256 | .002 | |
| | Standard scores for the STAI-6 (Pre-test) | -.170 | .069 | -.291 | -2.479 | .017 | |
| | AQ_TotalLiK | -.613 | .227 | -.310 | -2.704 | .009 | |
| | Inhibit | .093 | .075 | .207 | 1.232 | .224 | |
| | Shift | .172 | .077 | .385 | 2.250 | .029 | |
| | Emotional Control | -.067 | .064 | -.142 | -1.043 | .302 | |
| | Self-Monitor | .153 | .067 | .324 | 2.267 | .028 | |
| | Initiate | .000 | .098 | .001 | .004 | .997 | |
| | Working Memory | -.226 | .093 | -.470 | -2.440 | .018 | |
| | Plan/Organise | .080 | .106 | .151 | .758 | .452 | |
| | Task Monitor | .012 | .093 | .023 | .128 | .898 | |
| | Organisation of Materials | .236 | .063 | .471 | 3.747 | .000 | |

a. Dependent Variable: Dangerous Driving

**Bootstrap for Coefficients**

| | | | Bootstrap[a] | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | BCa 95% Confidence In | |
| Model | | B | Bias | Std. Error | Sig. (2-tailed) | Lower | Up |
| 1 | (Constant) | 15.415 | -1.358 | 5.632 | .018 | 6.743 | |
| | Standard scores for the STAI-6 (Pre-test) | -.170 | .004 | .067 | .020 | -.299 | |
| | AQ_TotalLiK | -.613 | .091 | .426 | .206 | -1.280 | |
| | Inhibit | .093 | .011 | .099 | .244 | -.038 | |
| | Shift | .172 | -.016 | .112 | .172 | -.041 | |
| | Emotional Control | -.067 | -.002 | .062 | .287 | -.207 | |
| | Self-Monitor | .153 | -.012 | .084 | .091 | .009 | |
| | Initiate | .000 | .005 | .091 | .997 | -.187 | |
| | Working Memory | -.226 | .025 | .149 | .180 | -.487 | |
| | Plan/Organise | .080 | .014 | .145 | .593 | -.168 | |
| | Task Monitor | .012 | -.028 | .098 | .902 | -.153 | |
| | Organisation of Materials | .236 | -.014 | .079 | .007 | .094 | |

a. Unless otherwise noted, bootstrap results are based on 10000 bootstrap samples

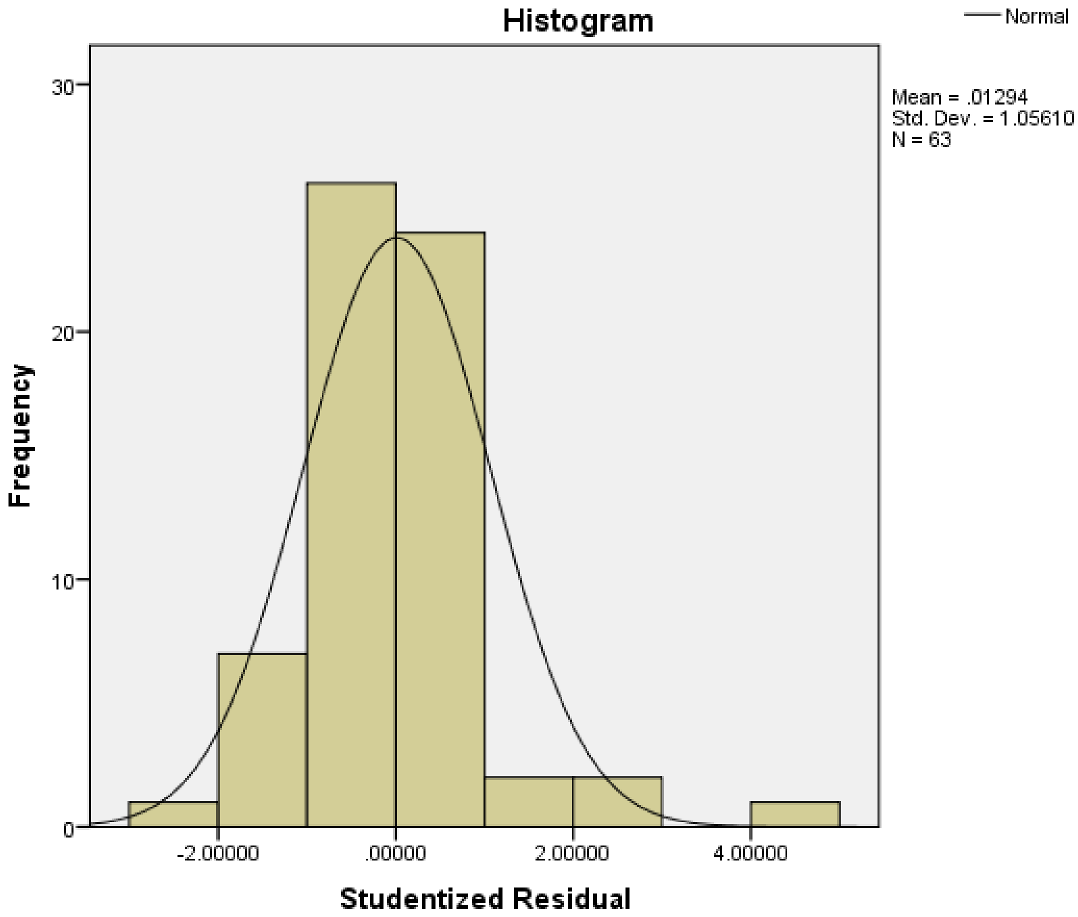
**Descriptives**

| | | | Statistic | Std. Error |
|---|---|---|---|---|
| Studentized Residual | Mean | | .0129396 | .13305583 |
| | 95% Confidence Interval for Mean | Lower Bound | -.2530352 | |
| | | Upper Bound | .2789145 | |
| | 5% Trimmed Mean | | -.0415935 | |
| | Median | | -.0696997 | |
| | Variance | | 1.115 | |
| | Std. Deviation | | 1.05609789 | |
| | Minimum | | -2.63937 | |
| | Maximum | | 4.12832 | |
| | Range | | 6.76769 | |
| | Interquartile Range | | 1.51980 | |
| | Skewness | | .941 | .302 |
| | Kurtosis | | 3.009 | .595 |

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| Studentized Residual | .113 | 63 | .045 | .938 | 63 | .003 |

a. Lilliefors Significance Correction




### 6.2.6 Neuropsychological Tests of EF and problematic Driving Outcomes

***Pedestrian Collisions and Double Letter Cancellation***

**Variables Entered/Removed[a]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | Double Letter Cancellation Test Total, Had an Accident, Age, AQ_TotalLiK[b] | . | Enter |

a. Dependent Variable: No of times having an accident with a pedestrian

b. All requested variables entered.

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .509[a] | .259 | .095 | .32764 |

a. Predictors: (Constant), Double Letter Cancellation Test Total, Had an Accident, Age, AQ_TotalLiK

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | .676 | 4 | .169 | 1.575 | .224[b] |
| | Residual | 1.932 | 18 | .107 | | |
| | Total | 2.609 | 22 | | | |

a. Dependent Variable: No of times having an accident with a pedestrian

b. Predictors: (Constant), Double Letter Cancellation Test Total, Had an Accident, Age, AQ_TotalLiK

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95 |
|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Lo |
| 1 | (Constant) | -2.116 | 1.287 | | -1.645 | .117 | |
| | Age | .054 | .034 | .346 | 1.578 | .132 | |
| | Had an Accident | -.146 | .162 | -.191 | -.901 | .379 | |
| | AQ_TotalLiK | .027 | .033 | .200 | .823 | .421 | |
| | Double Letter Cancellation Test Total | .048 | .022 | .542 | 2.224 | .039 | |

a. Dependent Variable: No of times having an accident with a pedestrian

### *Right of Way Violation and Stroop Task*

**Variables Entered/Removed[a]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | Double Letter Cancellation Test Total, Age, Stroop Task incong-cong, AQ_TotalLiK, Had an Accident[b] | . | Enter |

a. Dependent Variable: No of times right of way was violated

b. All requested variables entered.

**Model Summary[b]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .679[a] | .462 | .293 | .87188 |

a. Predictors: (Constant), Double Letter Cancellation Test Total, Age, Stroop Task incong-cong, AQ_TotalLiK, Had an Accident

b. Dependent Variable: No of times right of way was violated

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 10.428 | 5 | 2.086 | 2.744 | .056[b] |
| | Residual | 12.163 | 16 | .760 | | |
| | Total | 22.591 | 21 | | | |

a. Dependent Variable: No of times right of way was violated

b. Predictors: (Constant), Double Letter Cancellation Test Total, Age, Stroop Task incong-cong, AQ_TotalLiK, Had an Accident

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95 |
|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Lo |
| 1 | (Constant) | 5.036 | 3.431 | | 1.468 | .162 | |
| | Age | -.064 | .092 | -.137 | -.690 | .500 | |
| | Had an Accident | -.462 | .520 | -.191 | -.889 | .387 | |
| | AQ_TotalLiK | -.152 | .089 | -.364 | -1.707 | .107 | |
| | Stroop Task incong-cong | 10.260 | 4.084 | .532 | 2.512 | .023 | |

| | | | | | |
|---|---|---|---|---|---|
| Double Letter Cancellation Test Total | .028 | .061 | .100 | .452 | .658 |

a. Dependent Variable: No of times right of way was violated

**Descriptives**

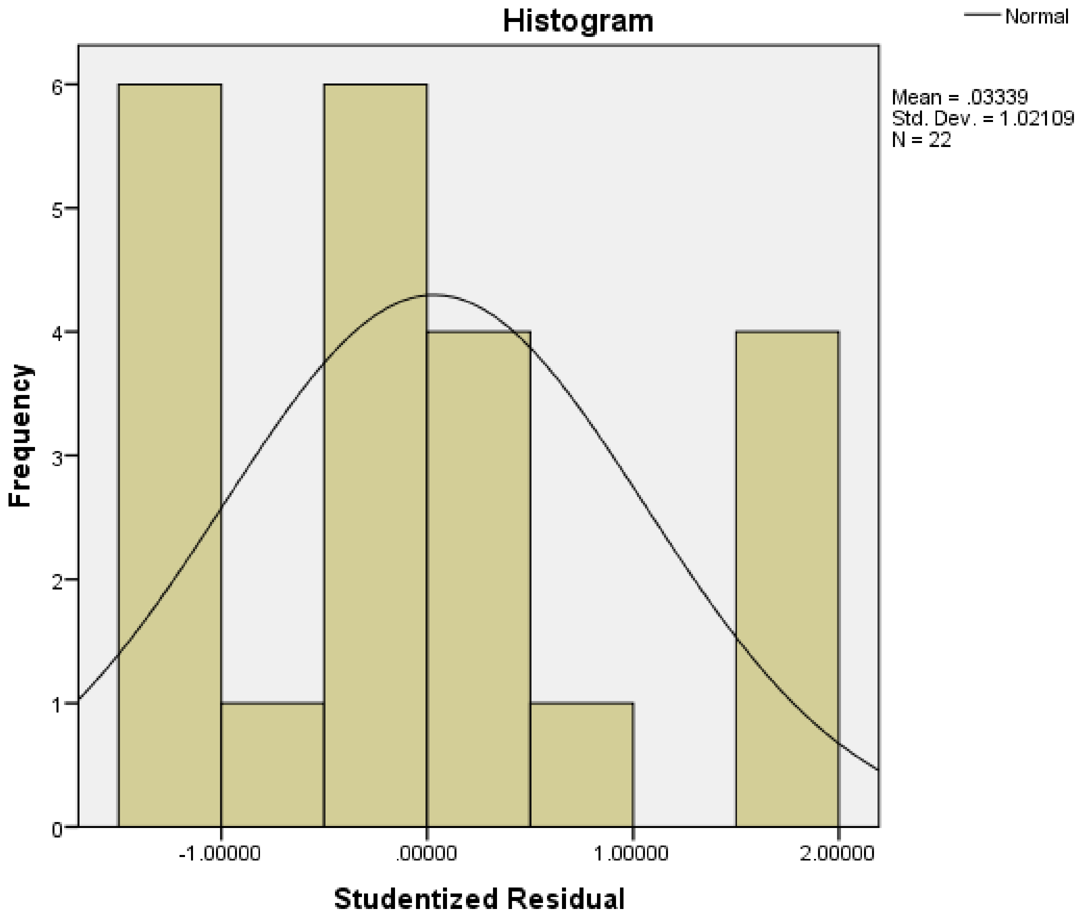
| | | | Statistic | Std. Error |
|---|---|---|---|---|
| Studentized Residual | Mean | | .0333949 | .21769686 |
| | 95% Confidence Interval for Mean | Lower Bound | -.4193305 | |
| | | Upper Bound | .4861203 | |
| | 5% Trimmed Mean | | -.0027112 | |
| | Median | | -.0925958 | |
| | Variance | | 1.043 | |
| | Std. Deviation | | 1.02108877 | |
| | Minimum | | -1.17952 | |
| | Maximum | | 1.89583 | |
| | Range | | 3.07535 | |
| | Interquartile Range | | 1.55930 | |
| | Skewness | | .648 | .491 |
| | Kurtosis | | -.599 | .953 |

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| Studentized Residual | .128 | 22 | .200* | .891 | 22 | .020 |

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction




**Variables Entered/Removed[a]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | Stroop Task incong-cong, AQ_TotalLiK[b] | . | Enter |

a. Dependent Variable: No of times right of way was violated

b. All requested variables entered.

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .628[a] | .395 | .334 | .82701 |

a. Predictors: (Constant), Stroop Task incong-cong, AQ_TotalLiK

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 8.930 | 2 | 4.465 | 6.528 | .007[b] |
| | Residual | 13.679 | 20 | .684 | | |
| | Total | 22.609 | 22 | | | |

a. Dependent Variable: No of times right of way was violated

b. Predictors: (Constant), Stroop Task incong-cong, AQ_TotalLiK

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95 |
|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Lo |
| 1 | (Constant) | 3.620 | 1.515 | | 2.390 | .027 | |
| | AQ_TotalLiK | -.154 | .072 | -.377 | -2.145 | .044 | |
| | Stroop Task incong-cong | 8.680 | 3.389 | .450 | 2.561 | .019 | |

a. Dependent Variable: No of times right of way was violated

**Bootstrap for Coefficients**

| Model | | B | Bootstrap[a] | | | | |
|---|---|---|---|---|---|---|---|
| | | | Bias | Std. Error | Sig. (2-tailed) | BCa 95% Confidence Int | |
| | | | | | | Lower | Upp |
| 1 | (Constant) | 3.620 | -.045 | 1.745 | .046 | -.117 | |
| | AQ_TotalLiK | -.154 | .001 | .082 | .072 | -.301 | |
| | Stroop Task incong-cong | 8.680 | .035 | 3.127 | .005 | 2.354 | |

a. Unless otherwise noted, bootstrap results are based on 10000 bootstrap samples

**Descriptives**

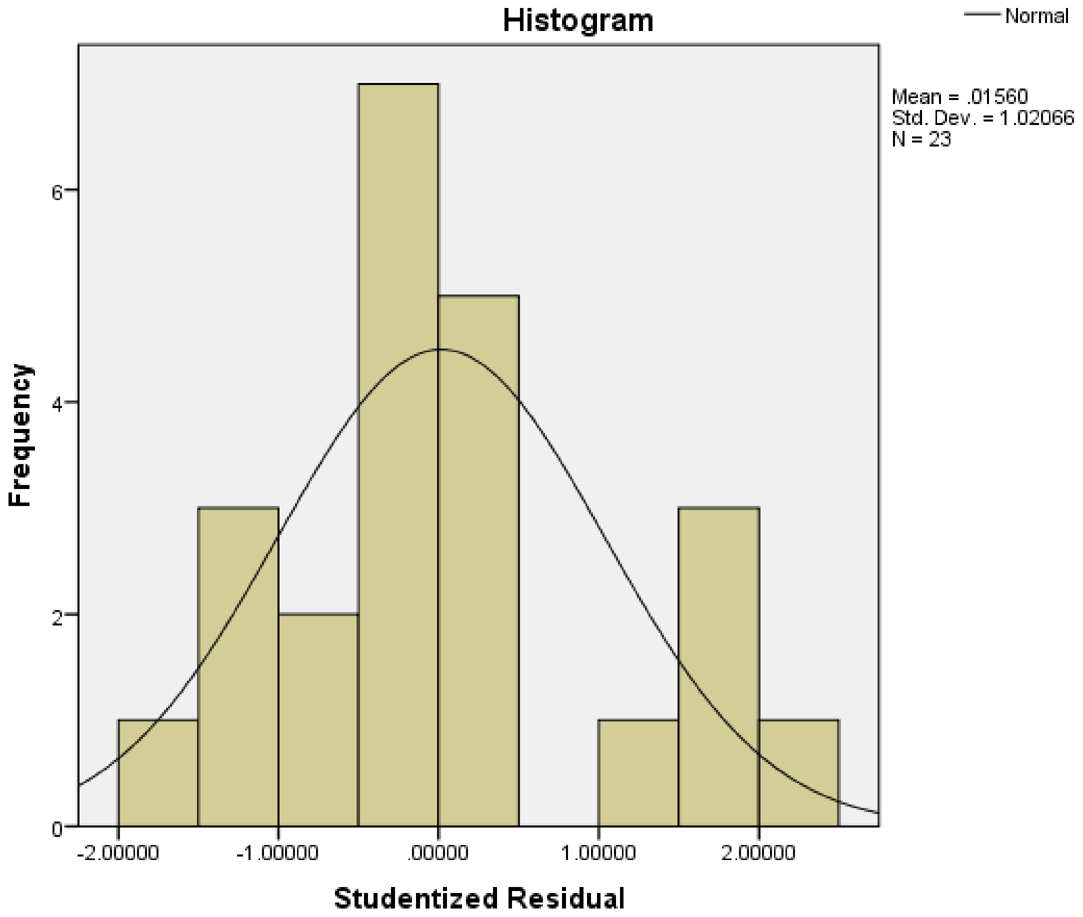
| | | | Statistic | Std. Error |
|---|---|---|---|---|
| Studentized Residual | Mean | | .0155958 | .21282331 |
| | 95% Confidence Interval for Mean | Lower Bound | -.4257727 | |
| | | Upper Bound | .4569643 | |
| | 5% Trimmed Mean | | -.0096187 | |
| | Median | | -.1539606 | |
| | Variance | | 1.042 | |

| | | | |
|---|---|---|---|
| | Std. Deviation | 1.02066475 | |
| | Minimum | -1.56142 | |
| | Maximum | 2.06146 | |
| | Range | 3.62287 | |
| | Interquartile Range | 1.08671 | |
| | Skewness | .607 | .481 |
| | Kurtosis | -.467 | .935 |

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| Studentized Residual | .181 | 23 | .048 | .922 | 23 | .075 |

a. Lilliefors Significance Correction



***Off Road and Stroop Task***

**Variables Entered/Removed[a]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | Stroop Task incong-cong, Age, AQ_TotalLiK, Had an Accident[b] | . | Enter |

a. Dependent Variable: No of times went off of the road

b. All requested variables entered.

**Model Summary[b]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .353[a] | .125 | -.081 | .82805 |

a. Predictors: (Constant), Stroop Task incong-cong, Age, AQ_TotalLiK, Had an Accident

b. Dependent Variable: No of times went off of the road

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 1.662 | 4 | .415 | .606 | .664[b] |
| | Residual | 11.656 | 17 | .686 | | |
| | Total | 13.318 | 21 | | | |

a. Dependent Variable: No of times went off of the road

b. Predictors: (Constant), Stroop Task incong-cong, Age, AQ_TotalLiK, Had an Accident

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t |
|---|---|---|---|---|---|
| 1 | (Constant) | .573 | 2.464 | | .232 |
| | Age | -.029 | .083 | -.083 | -.354 |
| | Had an Accident | .320 | .480 | .173 | .668 |
| | AQ_TotalLiK | -.011 | .075 | -.035 | -.149 |
| | Stroop Task incong-cong | 3.515 | 3.856 | .237 | .911 |

a. Dependent Variable: No of times went off of the road

## Descriptives

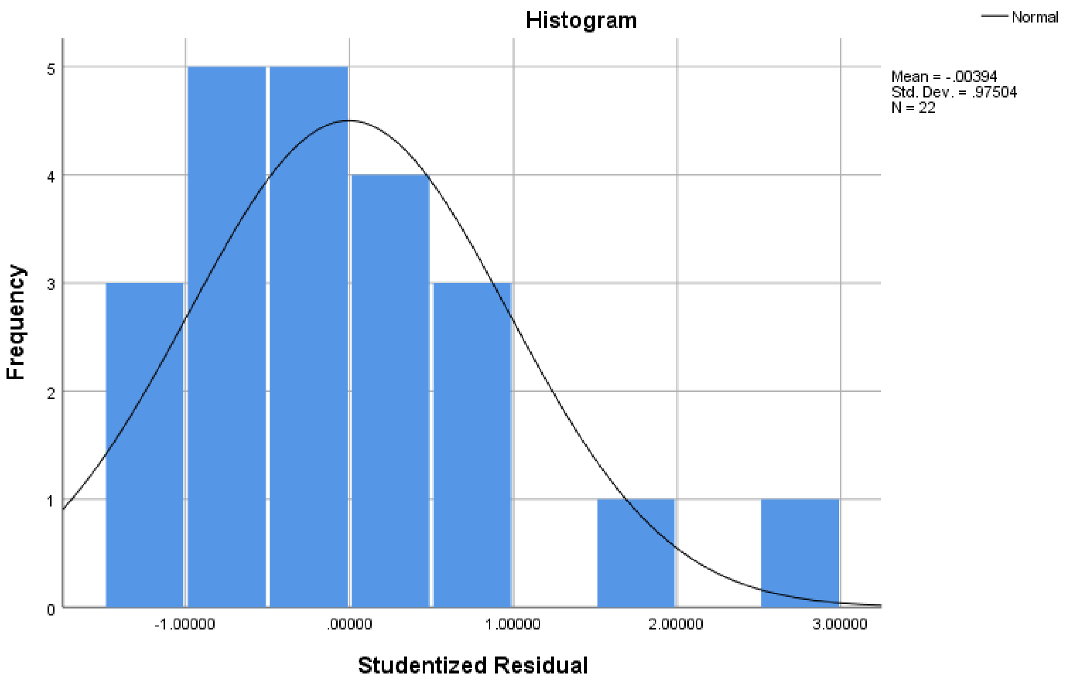
| | | | Statistic | Std. Error |
|---|---|---|---|---|
| Studentized Residual | Mean | | -.0039428 | .20787859 |
| | 95% Confidence Interval for Mean | Lower Bound | -.4362500 | |
| | | Upper Bound | .4283644 | |
| | 5% Trimmed Mean | | -.0961720 | |
| | Median | | -.0697252 | |
| | Variance | | .951 | |
| | Std. Deviation | | .97503699 | |
| | Minimum | | -1.18544 | |
| | Maximum | | 2.94588 | |
| | Range | | 4.13132 | |
| | Interquartile Range | | 1.13195 | |
| | Skewness | | 1.465 | .491 |
| | Kurtosis | | 2.915 | .953 |

## Tests of Normality

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | S |
| Studentized Residual | .131 | 22 | .200* | .886 | 22 | |

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction



### *Red Light and Trail Making*

**Variables Entered/Removed[a]**

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| 1 | Trail Making Task B-A, Had an Accident, AQ_TotalLiK, Age[b] | . | Enter |

a. Dependent Variable: No of times running a red light

b. All requested variables entered.

**Model Summary[b]**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .433[a] | .188 | .007 | .66293 |

a. Predictors: (Constant), Trail Making Task B-A, Had an Accident, AQ_TotalLiK, Age

b. Dependent Variable: No of times running a red light

**ANOVA[a]**

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 1.829 | 4 | .457 | 1.040 | .414[b] |
| | Residual | 7.911 | 18 | .439 | | |
| | Total | 9.739 | 22 | | | |

a. Dependent Variable: No of times running a red light

b. Predictors: (Constant), Trail Making Task B-A, Had an Accident, AQ_TotalLiK, Age

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% C |
|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Lower B |
| 1 | (Constant) | -.578 | 1.906 | | -.303 | .765 | |
| | Age | .086 | .071 | .283 | 1.204 | .244 | |

| | | | | | |
|---|---|---|---|---|---|
| Had an Accident | -.162 | .325 | -.110 | -.499 | .624 |
| AQ_TotalLiK | .013 | .058 | .051 | .231 | .820 |
| Trail Making Task B-A | -.028 | .014 | -.450 | -1.944 | .068 |

a. Dependent Variable: No of times running a red light

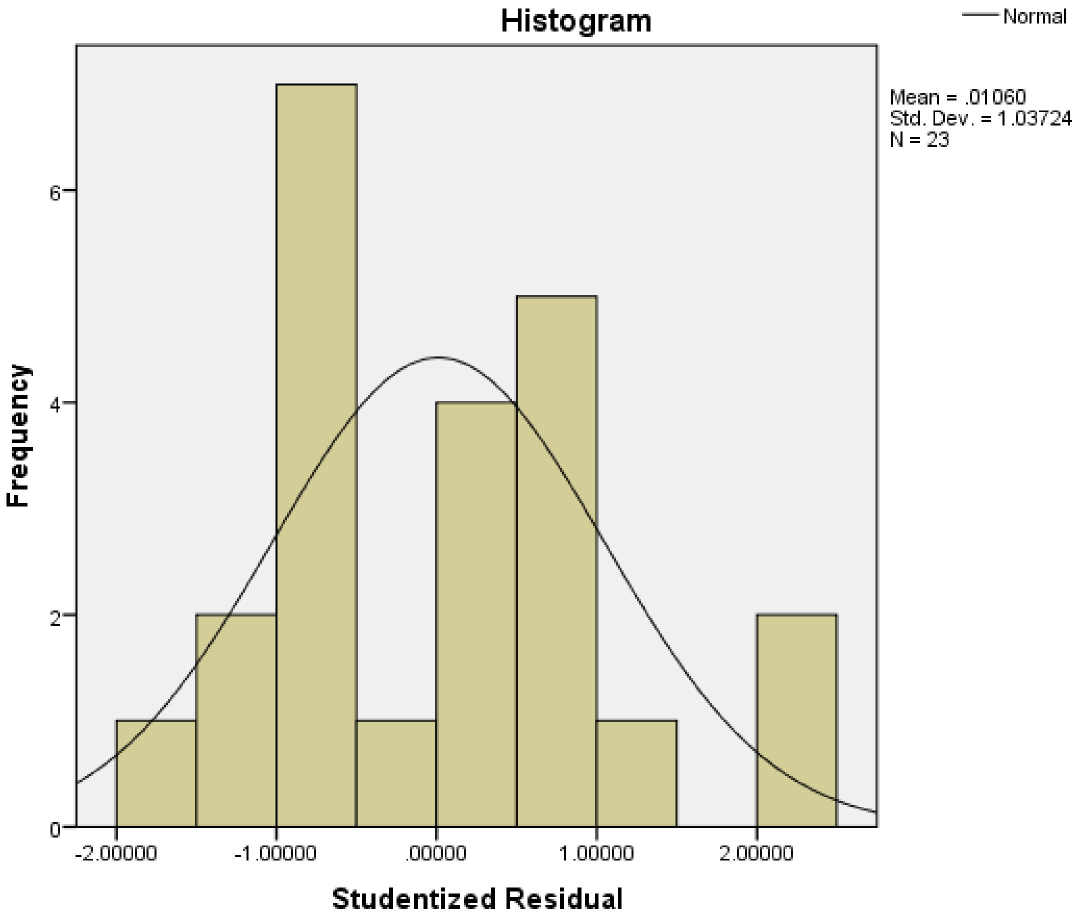
**Descriptives**

| | | | Statistic | Std. Error |
|---|---|---|---|---|
| Studentized Residual | Mean | | .0106043 | .21627955 |
| | 95% Confidence Interval for Mean | Lower Bound | -.4379321 | |
| | | Upper Bound | .4591406 | |
| | 5% Trimmed Mean | | -.0304834 | |
| | Median | | .0715445 | |
| | Variance | | 1.076 | |
| | Std. Deviation | | 1.03724030 | |
| | Minimum | | -1.54757 | |
| | Maximum | | 2.30355 | |
| | Range | | 3.85112 | |
| | Interquartile Range | | 1.51536 | |
| | Skewness | | .594 | .481 |
| | Kurtosis | | -.115 | .935 |

**Tests of Normality**

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| Studentized Residual | .154 | 23 | .168 | .944 | 23 | .222 |

a. Lilliefors Significance Correction


Histogram
Normal
Mean = .01060
Std. Dev. = 1.03724
N = 23
Frequency
0
2
4
6
-2.00000
-1.00000
.00000
1.00000
2.00000
Studentized Residual

### 6.2.7 Executive Function and Autistic Traits

***Independent samples t-tests***

**Descriptives**

| | Autistic Traits Group | | | Statistic | Std. Error |
|---|---|---|---|---|---|
| Inhibit | Low Autistic Traits | Mean | | 52.000 | 1.8739 |
| | | 95% Confidence Interval for Mean | Lower Bound | 48.187 | |
| | | | Upper Bound | 55.813 | |
| | | 5% Trimmed Mean | | 51.408 | |
| | | Median | | 50.000 | |
| | | Variance | | 119.394 | |
| | | Std. Deviation | | 10.9268 | |
| | | Minimum | | 36.0 | |
| | | Maximum | | 77.0 | |
| | | Range | | 41.0 | |
| | | Interquartile Range | | 17.0 | |
| | | Skewness | | .788 | .403 |
| | | Kurtosis | | -.193 | .788 |
| | High Autistic Traits | Mean | | 56.324 | 2.4887 |
| | | 95% Confidence Interval for Mean | Lower Bound | 51.260 | |
| | | | Upper Bound | 61.387 | |
| | | 5% Trimmed Mean | | 57.160 | |
| | | Median | | 57.000 | |
| | | Variance | | 210.589 | |
| | | Std. Deviation | | 14.5117 | |
| | | Minimum | | .0 | |
| | | Maximum | | 84.0 | |
| | | Range | | 84.0 | |
| | | Interquartile Range | | 17.0 | |
| | | Skewness | | -1.581 | .403 |
| | | Kurtosis | | 5.963 | .788 |
| Shift | Low Autistic Traits | Mean | | 49.9118 | 2.03024 |
| | | 95% Confidence Interval for Mean | Lower Bound | 45.7812 | |

| | | | | | |
|---|---|---|---|---|---|
| | | | Upper Bound | 54.0423 | |
| | | 5% Trimmed Mean | | 49.0131 | |
| | | Median | | 47.0000 | |
| | | Variance | | 140.143 | |
| | | Std. Deviation | | 11.83822 | |
| | | Minimum | | 39.00 | |
| | | Maximum | | 77.00 | |
| | | Range | | 38.00 | |
| | | Interquartile Range | | 17.00 | |
| | | Skewness | | 1.081 | .403 |
| | | Kurtosis | | .101 | .788 |
| | High Autistic Traits | Mean | | 58.4412 | 2.08303 |
| | | 95% Confidence Interval for Mean | Lower Bound | 54.2032 | |
| | | | Upper Bound | 62.6791 | |
| | | 5% Trimmed Mean | | 58.4902 | |
| | | Median | | 60.0000 | |
| | | Variance | | 147.527 | |
| | | Std. Deviation | | 12.14606 | |
| | | Minimum | | 39.00 | |
| | | Maximum | | 77.00 | |
| | | Range | | 38.00 | |
| | | Interquartile Range | | 22.00 | |
| | | Skewness | | -.191 | .403 |
| | | Kurtosis | | -1.259 | .788 |
| Emotional Control | Low Autistic Traits | Mean | | 54.2941 | 1.94282 |
| | | 95% Confidence Interval for Mean | Lower Bound | 50.3414 | |
| | | | Upper Bound | 58.2468 | |
| | | 5% Trimmed Mean | | 53.8170 | |
| | | Median | | 51.0000 | |
| | | Variance | | 128.335 | |
| | | Std. Deviation | | 11.32851 | |
| | | Minimum | | 38.00 | |
| | | Maximum | | 80.00 | |
| | | Range | | 42.00 | |
| | | Interquartile Range | | 17.00 | |
| | | Skewness | | .570 | .403 |

| | | | | | |
|---|---|---|---|---|---|
| | | Kurtosis | | -.608 | .788 |
| | High Autistic Traits | Mean | | 57.2059 | 2.29499 |
| | | 95% Confidence Interval for Mean | Lower Bound | 52.5367 | |
| | | | Upper Bound | 61.8751 | |
| | | 5% Trimmed Mean | | 57.0065 | |
| | | Median | | 56.0000 | |
| | | Variance | | 179.078 | |
| | | Std. Deviation | | 13.38199 | |
| | | Minimum | | 38.00 | |
| | | Maximum | | 80.00 | |
| | | Range | | 42.00 | |
| | | Interquartile Range | | 23.75 | |
| | | Skewness | | .215 | .403 |
| | | Kurtosis | | -1.180 | .788 |
| Self-Monitor | Low Autistic Traits | Mean | | 47.2353 | 1.91535 |
| | | 95% Confidence Interval for Mean | Lower Bound | 43.3385 | |
| | | | Upper Bound | 51.1321 | |
| | | 5% Trimmed Mean | | 46.2974 | |
| | | Median | | 46.0000 | |
| | | Variance | | 124.731 | |
| | | Std. Deviation | | 11.16830 | |
| | | Minimum | | 37.00 | |
| | | Maximum | | 76.00 | |
| | | Range | | 39.00 | |
| | | Interquartile Range | | 17.00 | |
| | | Skewness | | 1.114 | .403 |
| | | Kurtosis | | .320 | .788 |
| | High Autistic Traits | Mean | | 54.3529 | 2.08931 |
| | | 95% Confidence Interval for Mean | Lower Bound | 50.1022 | |
| | | | Upper Bound | 58.6037 | |
| | | 5% Trimmed Mean | | 53.8922 | |
| | | Median | | 54.0000 | |
| | | Variance | | 148.417 | |
| | | Std. Deviation | | 12.18266 | |
| | | Minimum | | 37.00 | |

| | | | | | |
|---|---|---|---|---|---|
| | | Maximum | | 80.00 | |
| | | Range | | 43.00 | |
| | | Interquartile Range | | 19.00 | |
| | | Skewness | | .561 | .403 |
| | | Kurtosis | | -.660 | .788 |
| Initiate | Low Autistic Traits | Mean | | 52.6471 | 1.72374 |
| | | 95% Confidence Interval for Mean | Lower Bound | 49.1401 | |
| | | | Upper Bound | 56.1540 | |
| | | 5% Trimmed Mean | | 52.0915 | |
| | | Median | | 53.0000 | |
| | | Variance | | 101.023 | |
| | | Std. Deviation | | 10.05103 | |
| | | Minimum | | 37.00 | |
| | | Maximum | | 82.00 | |
| | | Range | | 45.00 | |
| | | Interquartile Range | | 14.00 | |
| | | Skewness | | .876 | .403 |
| | | Kurtosis | | 1.020 | .788 |
| | High Autistic Traits | Mean | | 55.8824 | 2.16345 |
| | | 95% Confidence Interval for Mean | Lower Bound | 51.4808 | |
| | | | Upper Bound | 60.2839 | |
| | | 5% Trimmed Mean | | 55.3824 | |
| | | Median | | 56.0000 | |
| | | Variance | | 159.137 | |
| | | Std. Deviation | | 12.61496 | |
| | | Minimum | | 37.00 | |
| | | Maximum | | 85.00 | |
| | | Range | | 48.00 | |
| | | Interquartile Range | | 16.00 | |
| | | Skewness | | .495 | .403 |
| | | Kurtosis | | -.240 | .788 |
| Working Memory | Low Autistic Traits | Mean | | 54.5882 | 2.02705 |
| | | 95% Confidence Interval for Mean | Lower Bound | 50.4642 | |
| | | | Upper Bound | 58.7123 | |
| | | 5% Trimmed Mean | | 53.7843 | |

| | | | | | |
|---|---|---|---|---|---|
| | | Median | | 51.0000 | |
| | | Variance | | 139.704 | |
| | | Std. Deviation | | 11.81965 | |
| | | Minimum | | 39.00 | |
| | | Maximum | | 83.00 | |
| | | Range | | 44.00 | |
| | | Interquartile Range | | 17.75 | |
| | | Skewness | | .943 | .403 |
| | | Kurtosis | | .132 | .788 |
| | High Autistic Traits | Mean | | 60.1176 | 2.06825 |
| | | 95% Confidence Interval for Mean | Lower Bound | 55.9098 | |
| | | | Upper Bound | 64.3255 | |
| | | 5% Trimmed Mean | | 60.1503 | |
| | | Median | | 61.0000 | |
| | | Variance | | 145.440 | |
| | | Std. Deviation | | 12.05986 | |
| | | Minimum | | 39.00 | |
| | | Maximum | | 79.00 | |
| | | Range | | 40.00 | |
| | | Interquartile Range | | 21.00 | |
| | | Skewness | | .091 | .403 |
| | | Kurtosis | | -1.258 | .788 |
| Plan/Organise | Low Autistic Traits | Mean | | 50.4118 | 1.76373 |
| | | 95% Confidence Interval for Mean | Lower Bound | 46.8234 | |
| | | | Upper Bound | 54.0001 | |
| | | 5% Trimmed Mean | | 49.7516 | |
| | | Median | | 47.5000 | |
| | | Variance | | 105.765 | |
| | | Std. Deviation | | 10.28420 | |
| | | Minimum | | 38.00 | |
| | | Maximum | | 78.00 | |
| | | Range | | 40.00 | |
| | | Interquartile Range | | 16.00 | |
| | | Skewness | | .917 | .403 |
| | | Kurtosis | | .188 | .788 |
| | | Mean | | 55.9706 | 1.91694 |

| | | | | | |
|---|---|---|---|---|---|
| | High Autistic Traits | 95% Confidence Interval for Mean | Lower Bound | 52.0705 | |
| | | | Upper Bound | 59.8706 | |
| | | 5% Trimmed Mean | | 55.2647 | |
| | | Median | | 54.0000 | |
| | | Variance | | 124.939 | |
| | | Std. Deviation | | 11.17759 | |
| | | Minimum | | 41.00 | |
| | | Maximum | | 89.00 | |
| | | Range | | 48.00 | |
| | | Interquartile Range | | 16.75 | |
| | | Skewness | | .856 | .403 |
| | | Kurtosis | | .818 | .788 |
| Task Monitor | Low Autistic Traits | Mean | | 52.9412 | 1.87199 |
| | | 95% Confidence Interval for Mean | Lower Bound | 49.1326 | |
| | | | Upper Bound | 56.7498 | |
| | | 5% Trimmed Mean | | 52.5294 | |
| | | Median | | 52.0000 | |
| | | Variance | | 119.148 | |
| | | Std. Deviation | | 10.91549 | |
| | | Minimum | | 36.00 | |
| | | Maximum | | 81.00 | |
| | | Range | | 45.00 | |
| | | Interquartile Range | | 15.00 | |
| | | Skewness | | .506 | .403 |
| | | Kurtosis | | -.036 | .788 |
| | High Autistic Traits | Mean | | 57.0294 | 1.97871 |
| | | 95% Confidence Interval for Mean | Lower Bound | 53.0037 | |
| | | | Upper Bound | 61.0551 | |
| | | 5% Trimmed Mean | | 56.8660 | |
| | | Median | | 54.0000 | |
| | | Variance | | 133.120 | |
| | | Std. Deviation | | 11.53778 | |
| | | Minimum | | 36.00 | |
| | | Maximum | | 81.00 | |
| | | Range | | 45.00 | |

| | | | | | |
|---|---|---|---|---|---|
| | | Interquartile Range | | 14.25 | |
| | | Skewness | | .421 | .403 |
| | | Kurtosis | | -.605 | .788 |
| Organisation of Materials | Low Autistic Traits | Mean | | 49.9706 | 1.88269 |
| | | 95% Confidence Interval for Mean | Lower Bound | 46.1402 | |
| | | | Upper Bound | 53.8010 | |
| | | 5% Trimmed Mean | | 49.3954 | |
| | | Median | | 48.5000 | |
| | | Variance | | 120.514 | |
| | | Std. Deviation | | 10.97790 | |
| | | Minimum | | 36.00 | |
| | | Maximum | | 78.00 | |
| | | Range | | 42.00 | |
| | | Interquartile Range | | 16.75 | |
| | | Skewness | | .686 | .403 |
| | | Kurtosis | | -.142 | .788 |
| | High Autistic Traits | Mean | | 51.2353 | 2.04976 |
| | | 95% Confidence Interval for Mean | Lower Bound | 47.0650 | |
| | | | Upper Bound | 55.4056 | |
| | | 5% Trimmed Mean | | 50.4967 | |
| | | Median | | 47.0000 | |
| | | Variance | | 142.852 | |
| | | Std. Deviation | | 11.95207 | |
| | | Minimum | | 36.00 | |
| | | Maximum | | 81.00 | |
| | | Range | | 45.00 | |
| | | Interquartile Range | | 16.75 | |
| | | Skewness | | .995 | .403 |
| | | Kurtosis | | .072 | .788 |
| Behavioural Regulation Index | Low Autistic Traits | Mean | | 51.8824 | 1.91614 |
| | | 95% Confidence Interval for Mean | Lower Bound | 47.9839 | |
| | | | Upper Bound | 55.7808 | |
| | | 5% Trimmed Mean | | 51.4052 | |
| | | Median | | 50.5000 | |
| | | Variance | | 124.834 | |

| | | | | | |
|---|---|---|---|---|---|
| | | Std. Deviation | | 11.17292 | |
| | | Minimum | | 36.00 | |
| | | Maximum | | 78.00 | |
| | | Range | | 42.00 | |
| | | Interquartile Range | | 15.50 | |
| | | Skewness | | .634 | .403 |
| | | Kurtosis | | -.468 | .788 |
| | High Autistic Traits | Mean | | 58.3235 | 2.09818 |
| | | 95% Confidence Interval for Mean | Lower Bound | 54.0548 | |
| | | | Upper Bound | 62.5923 | |
| | | 5% Trimmed Mean | | 58.2451 | |
| | | Median | | 57.5000 | |
| | | Variance | | 149.680 | |
| | | Std. Deviation | | 12.23438 | |
| | | Minimum | | 34.00 | |
| | | Maximum | | 82.00 | |
| | | Range | | 48.00 | |
| | | Interquartile Range | | 19.00 | |
| | | Skewness | | .075 | .403 |
| | | Kurtosis | | -.675 | .788 |
| Metacognition Index | Low Autistic Traits | Mean | | 52.4118 | 1.81011 |
| | | 95% Confidence Interval for Mean | Lower Bound | 48.7291 | |
| | | | Upper Bound | 56.0945 | |
| | | 5% Trimmed Mean | | 51.7353 | |
| | | Median | | 50.0000 | |
| | | Variance | | 111.401 | |
| | | Std. Deviation | | 10.55467 | |
| | | Minimum | | 38.00 | |
| | | Maximum | | 79.00 | |
| | | Range | | 41.00 | |
| | | Interquartile Range | | 13.25 | |
| | | Skewness | | .863 | .403 |
| | | Kurtosis | | .543 | .788 |
| | High Autistic Traits | Mean | | 56.9118 | 2.00950 |
| | | 95% Confidence Interval for Mean | Lower Bound | 52.8234 | |

| | | | | | |
|---|---|---|---|---|---|
| | | | Upper Bound | 61.0001 | |
| | | 5% Trimmed Mean | | 56.3627 | |
| | | Median | | 55.0000 | |
| | | Variance | | 137.295 | |
| | | Std. Deviation | | 11.71730 | |
| | | Minimum | | 39.00 | |
| | | Maximum | | 88.00 | |
| | | Range | | 49.00 | |
| | | Interquartile Range | | 16.50 | |
| | | Skewness | | .835 | .403 |
| | | Kurtosis | | .216 | .788 |
| Global Executive Composite | Low Autistic Traits | Mean | | 52.3529 | 1.86720 |
| | | 95% Confidence Interval for Mean | Lower Bound | 48.5541 | |
| | | | Upper Bound | 56.1518 | |
| | | 5% Trimmed Mean | | 51.7386 | |
| | | Median | | 51.5000 | |
| | | Variance | | 118.538 | |
| | | Std. Deviation | | 10.88753 | |
| | | Minimum | | 36.00 | |
| | | Maximum | | 81.00 | |
| | | Range | | 45.00 | |
| | | Interquartile Range | | 15.75 | |
| | | Skewness | | .736 | .403 |
| | | Kurtosis | | .416 | .788 |
| | High Autistic Traits | Mean | | 58.1176 | 1.99588 |
| | | 95% Confidence Interval for Mean | Lower Bound | 54.0570 | |
| | | | Upper Bound | 62.1783 | |
| | | 5% Trimmed Mean | | 57.8529 | |
| | | Median | | 57.5000 | |
| | | Variance | | 135.440 | |
| | | Std. Deviation | | 11.63788 | |
| | | Minimum | | 39.00 | |
| | | Maximum | | 82.00 | |
| | | Range | | 43.00 | |
| | | Interquartile Range | | 20.25 | |
| | | Skewness | | .303 | .403 |

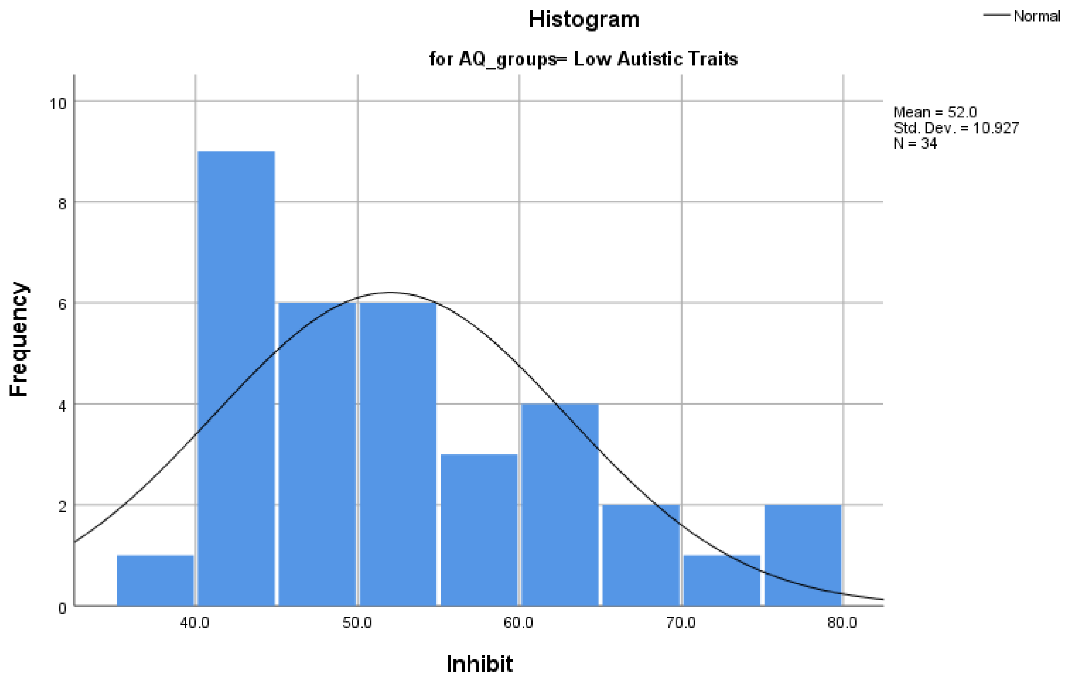
| | | |
|---|---|---|
| Kurtosis | -.860 | .788 |

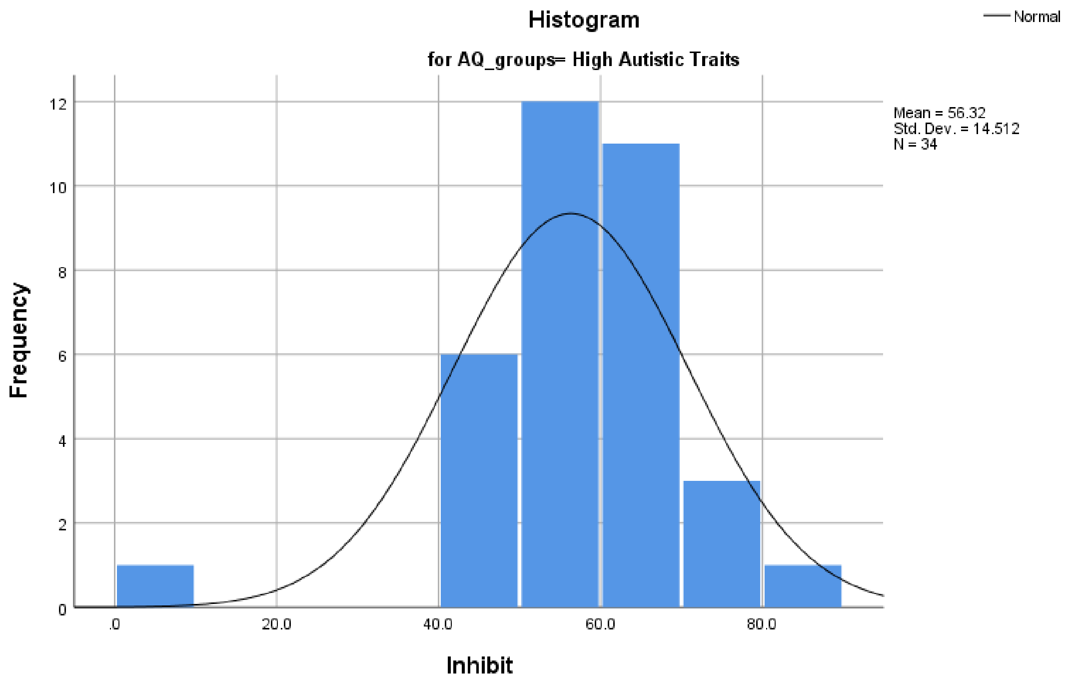
**Tests of Normality**

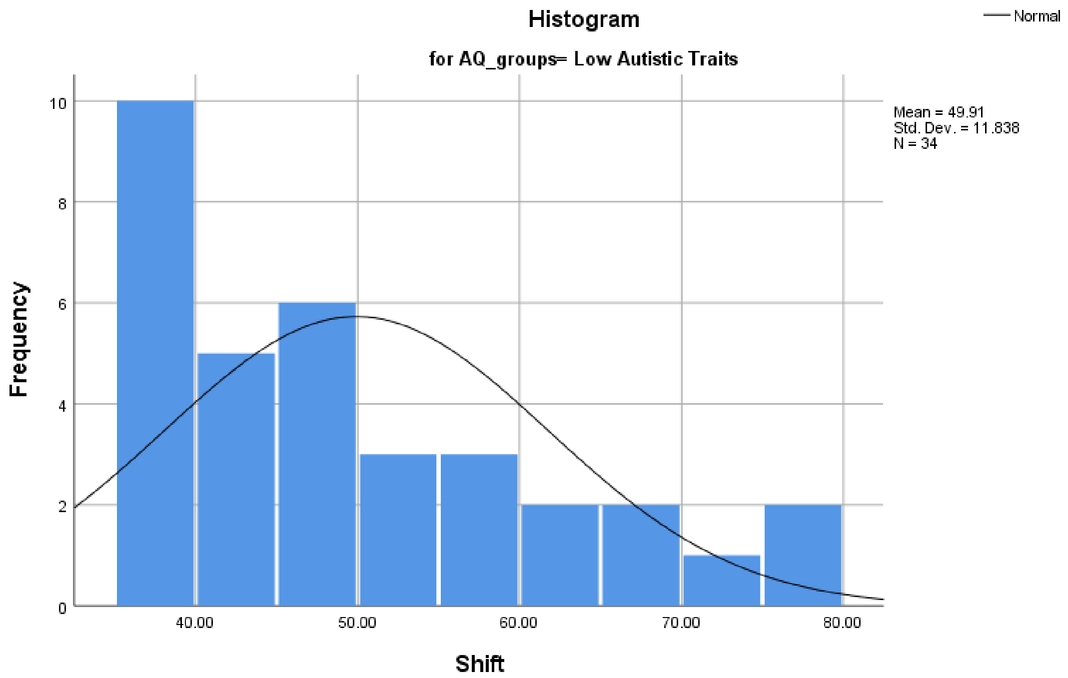
| | | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|---|
| | Autistic Traits Group | Statistic | df | Sig. | Statistic | df | Sig. |
| Inhibit | Low Autistic Traits | .179 | 34 | .007 | .920 | 34 | .016 |
| | High Autistic Traits | .145 | 34 | .069 | .877 | 34 | .001 |
| Shift | Low Autistic Traits | .215 | 34 | .000 | .836 | 34 | .000 |
| | High Autistic Traits | .150 | 34 | .049 | .925 | 34 | .023 |
| Emotional Control | Low Autistic Traits | .173 | 34 | .011 | .941 | 34 | .065 |
| | High Autistic Traits | .112 | 34 | .200* | .934 | 34 | .041 |
| Self-Monitor | Low Autistic Traits | .250 | 34 | .000 | .836 | 34 | .000 |
| | High Autistic Traits | .195 | 34 | .002 | .925 | 34 | .022 |
| Initiate | Low Autistic Traits | .221 | 34 | .000 | .935 | 34 | .043 |
| | High Autistic Traits | .114 | 34 | .200* | .959 | 34 | .232 |
| Working Memory | Low Autistic Traits | .182 | 34 | .006 | .891 | 34 | .003 |
| | High Autistic Traits | .164 | 34 | .022 | .937 | 34 | .052 |
| Plan/Organise | Low Autistic Traits | .166 | 34 | .018 | .910 | 34 | .009 |
| | High Autistic Traits | .158 | 34 | .031 | .939 | 34 | .056 |
| Task Monitor | Low Autistic Traits | .138 | 34 | .100 | .959 | 34 | .224 |
| | High Autistic Traits | .170 | 34 | .014 | .950 | 34 | .124 |
| Organisation of Materials | Low Autistic Traits | .119 | 34 | .200* | .938 | 34 | .053 |
| | High Autistic Traits | .197 | 34 | .002 | .889 | 34 | .002 |
| Behavioural Regulation Index | Low Autistic Traits | .143 | 34 | .076 | .940 | 34 | .061 |
| | High Autistic Traits | .085 | 34 | .200* | .977 | 34 | .692 |
| Metacognition Index | Low Autistic Traits | .133 | 34 | .137 | .930 | 34 | .031 |
| | High Autistic Traits | .178 | 34 | .008 | .937 | 34 | .051 |
| Global Executive Composite | Low Autistic Traits | .100 | 34 | .200* | .948 | 34 | .109 |
| | High Autistic Traits | .110 | 34 | .200* | .963 | 34 | .291 |

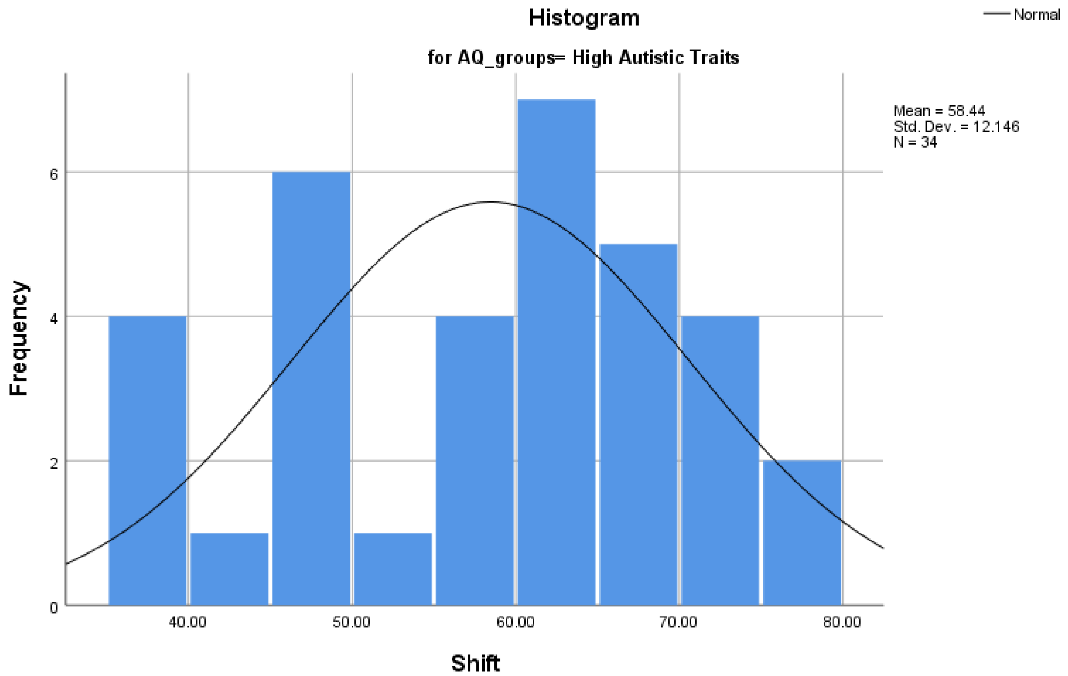
*. This is a lower bound of the true significance.

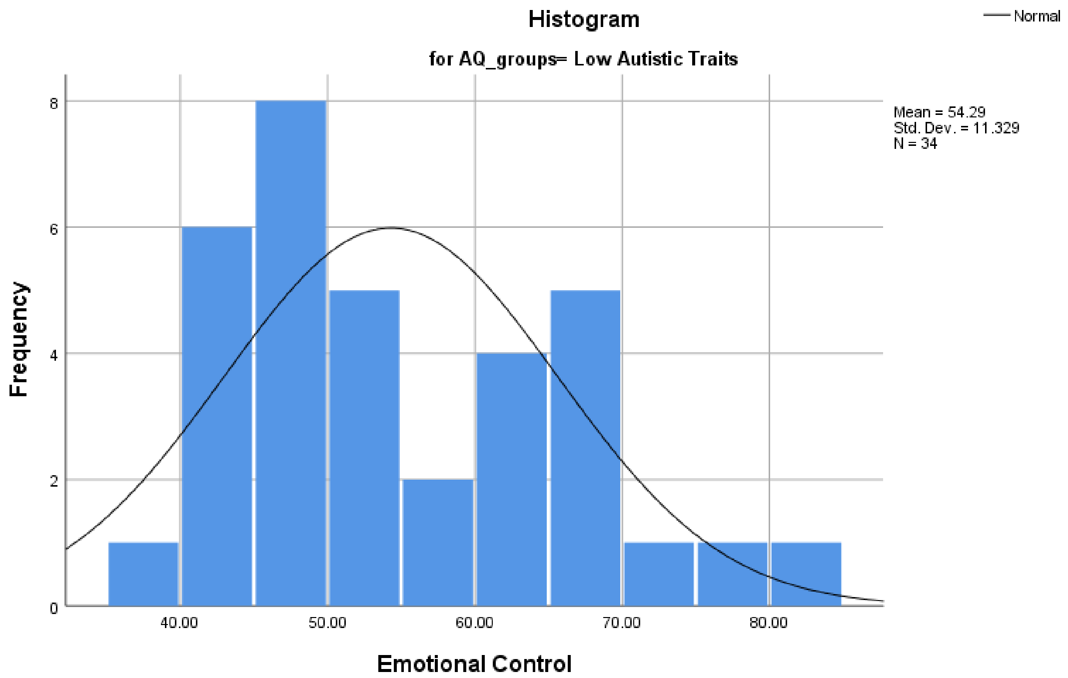
a. Lilliefors Significance Correction

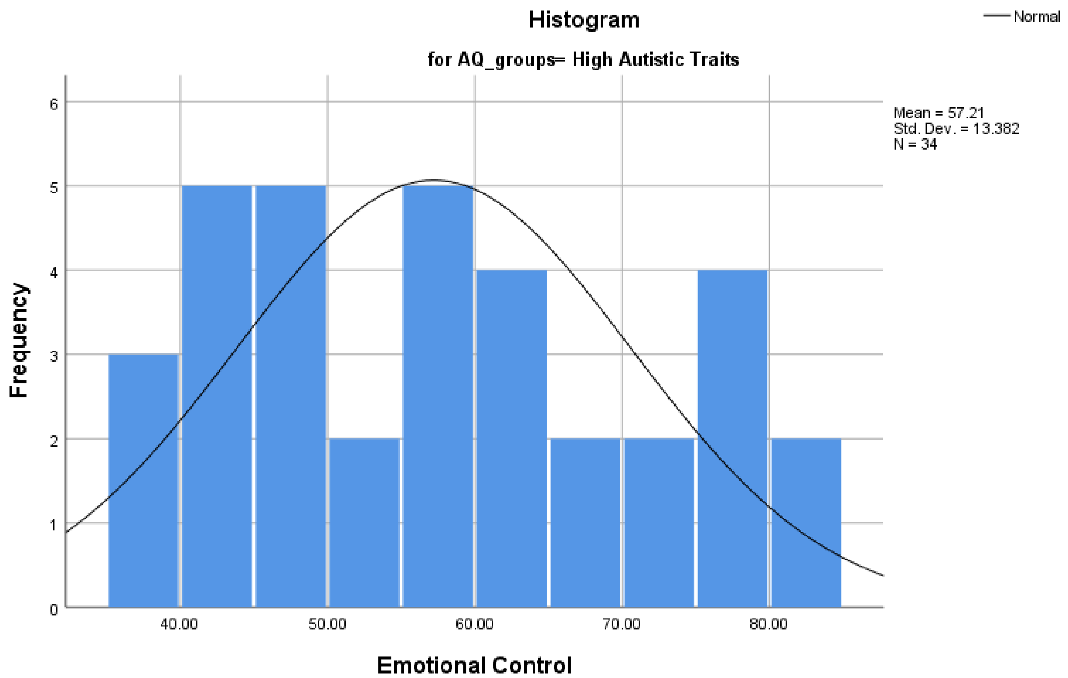

Histogram
for AQ_groups= Low Autistic Traits
Normal
Mean = 52.0
Std. Dev. = 10.927
N = 34
Frequency
Inhibit
0
2
4
6
8
10
40.0
50.0
60.0
70.0
80.0


Histogram
for AQ_groups= High Autistic Traits
Normal
Mean = 56.32
Std. Dev. = 14.512
N = 34
Frequency
Inhibit
0
2
4
6
8
10
12
.0
20.0
40.0
60.0
80.0


Histogram
for AQ_groups= Low Autistic Traits
Normal
Mean = 49.91
Std. Dev. = 11.838
N = 34
Frequency
Shift
0
2
4
6
8
10
40.00
50.00
60.00
70.00
80.00


Histogram
for AQ_groups= High Autistic Traits
Normal
Mean = 58.44
Std. Dev. = 12.146
N = 34
Frequency
Shift
0
2
4
6
40.00
50.00
60.00
70.00
80.00


Histogram
for AQ_groups= Low Autistic Traits
Normal
Mean = 54.29
Std. Dev. = 11.329
N = 34
Frequency
0
2
4
6
8
40.00
50.00
60.00
70.00
80.00
Emotional Control


Histogram
for AQ_groups= High Autistic Traits
Normal
Mean = 57.21
Std. Dev. = 13.382
N = 34
Frequency
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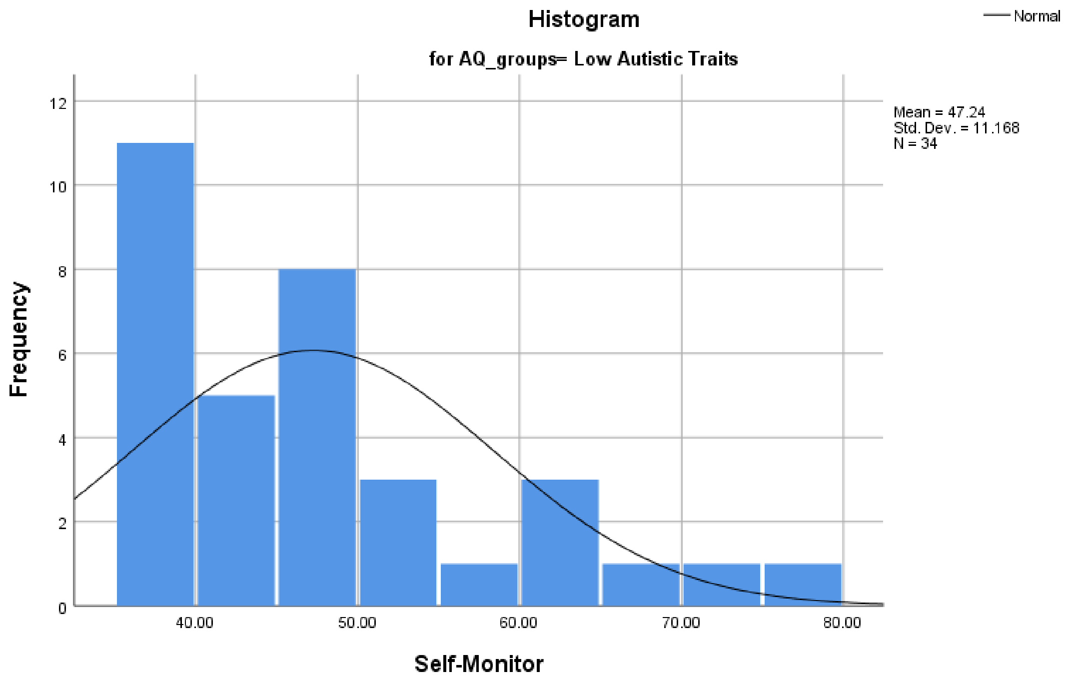
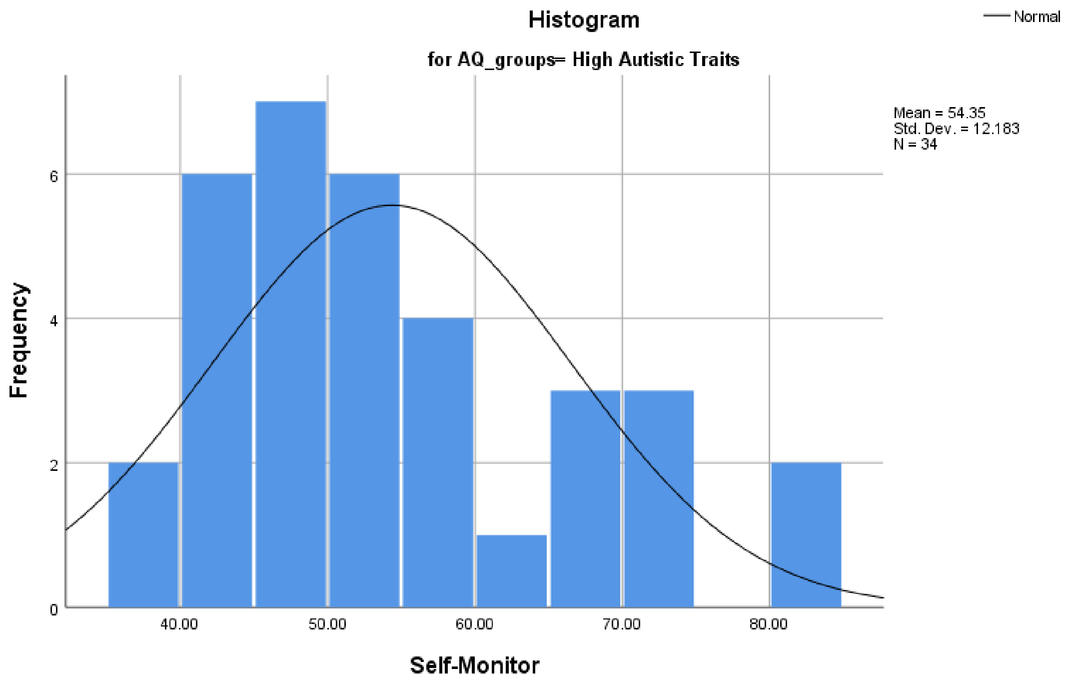
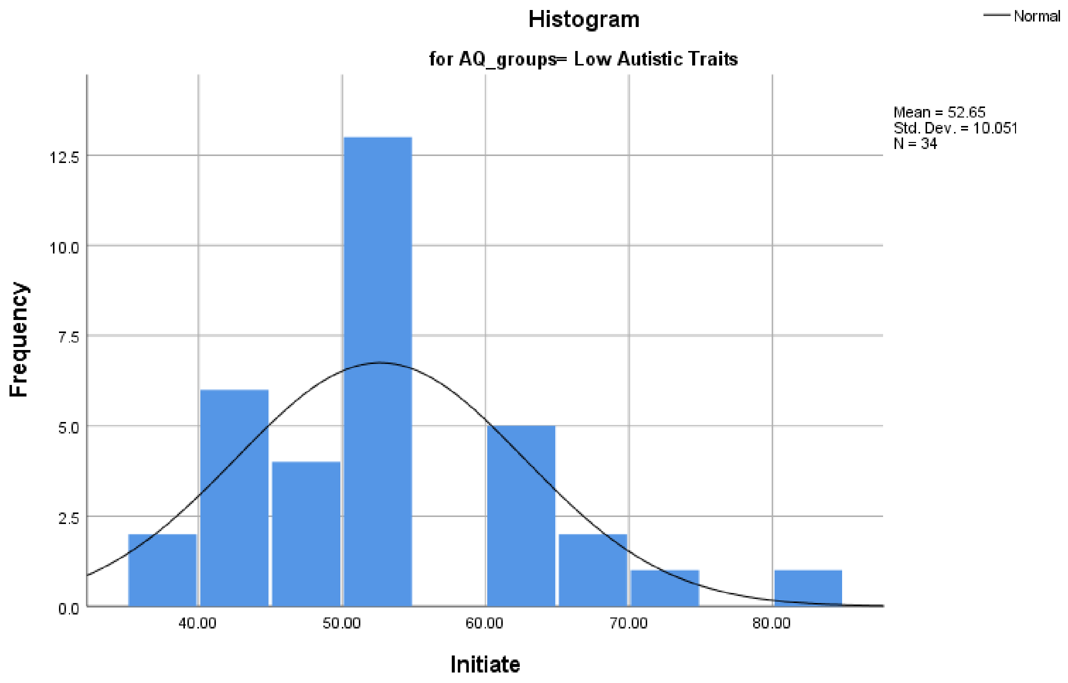
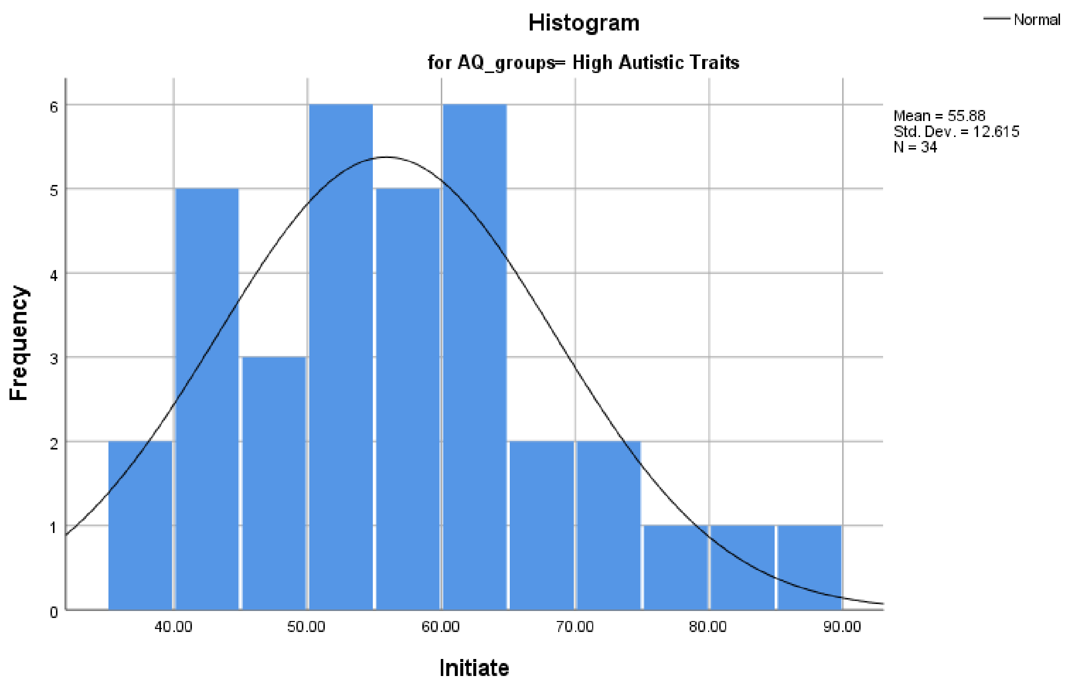
1
2
3
4
5
6
40.00
50.00
60.00
70.00
80.00
Emotional Control


Histogram
for AQ_groups= Low Autistic Traits
Normal
Mean = 47.24
Std. Dev. = 11.168
N = 34
Frequency
0
2
4
6
8
10
12
40.00
50.00
60.00
70.00
80.00
Self-Monitor


Histogram
for AQ_groups= High Autistic Traits
Normal
Mean = 54.35
Std. Dev. = 12.183
N = 34
Frequency
0
2
4
6
40.00
50.00
60.00
70.00
80.00
Self-Monitor



Histogram
for AQ_groups= Low Autistic Traits
Normal
Mean = 52.65
Std. Dev. = 10.051
N = 34
Frequency
0.0
2.5
5.0
7.5
10.0
12.5
40.00
50.00
60.00
70.00
80.00
Initiate

Histogram
for AQ_groups= High Autistic Traits
Normal
Mean = 55.88
Std. Dev. = 12.615
N = 34
Frequency
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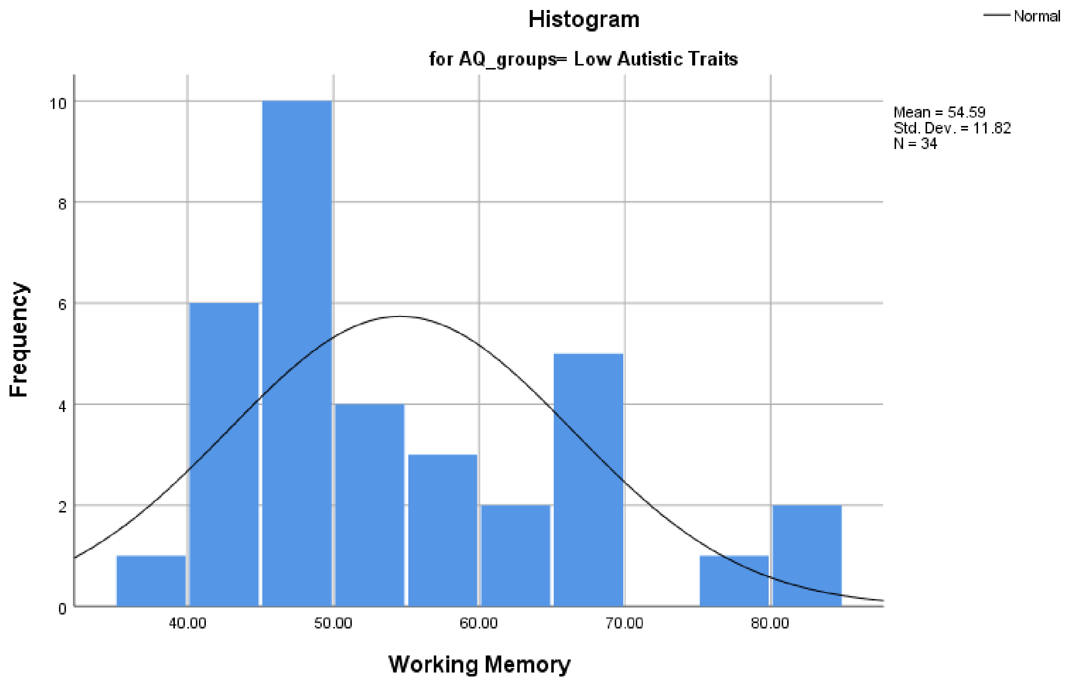
1
2
3
4
5
6
40.00
50.00
60.00
70.00
80.00
90.00
Initiate


Histogram
for AQ_groups= Low Autistic Traits
Normal
Mean = 54.59
Std. Dev. = 11.82
N = 34
Frequency
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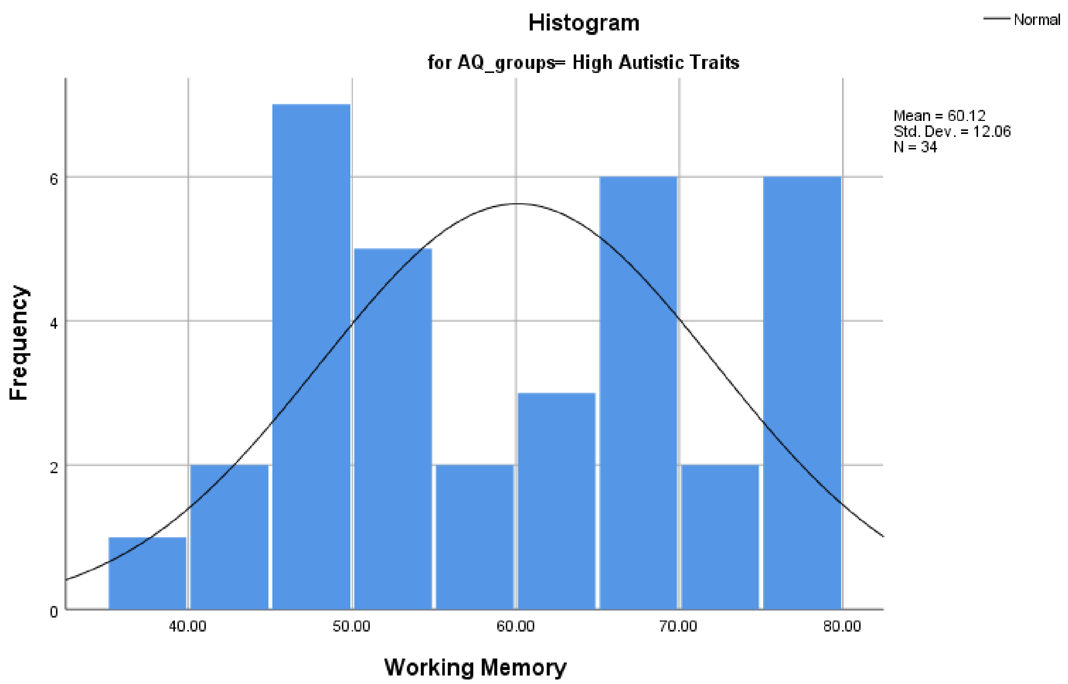
2
4
6
8
10
40.00
50.00
60.00
70.00
80.00
Working Memory


Histogram
for AQ_groups= High Autistic Traits
Normal
Mean = 60.12
Std. Dev. = 12.06
N = 34
Frequency
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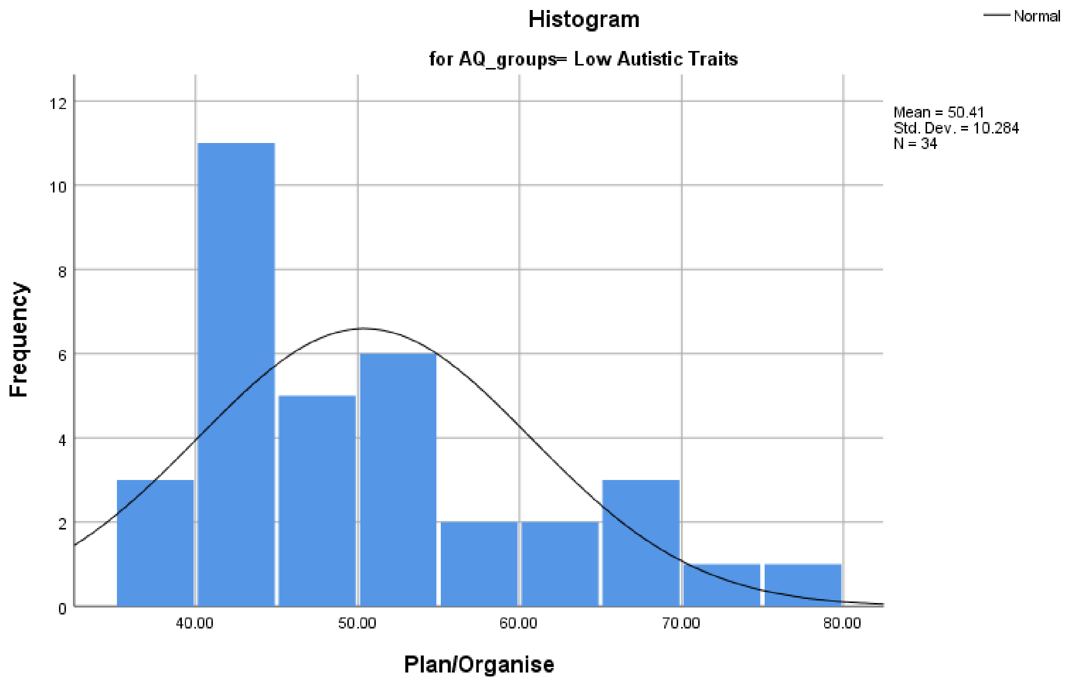
2
4
6
40.00
50.00
60.00
70.00
80.00
Working Memory


Histogram
for AQ_groups= Low Autistic Traits
Normal
Mean = 50.41
Std. Dev. = 10.284
N = 34
Frequency
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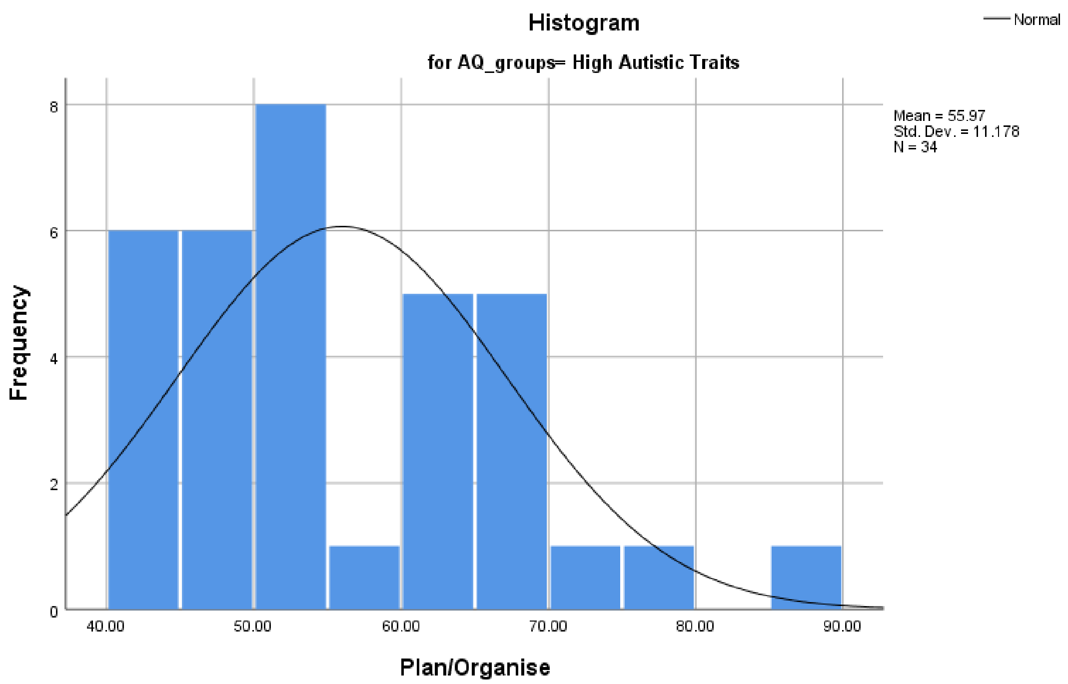
2
4
6
8
10
12
40.00
50.00
60.00
70.00
80.00
Plan/Organise


Histogram
for AQ_groups= High Autistic Traits
Normal
Mean = 55.97
Std. Dev. = 11.178
N = 34
Frequency
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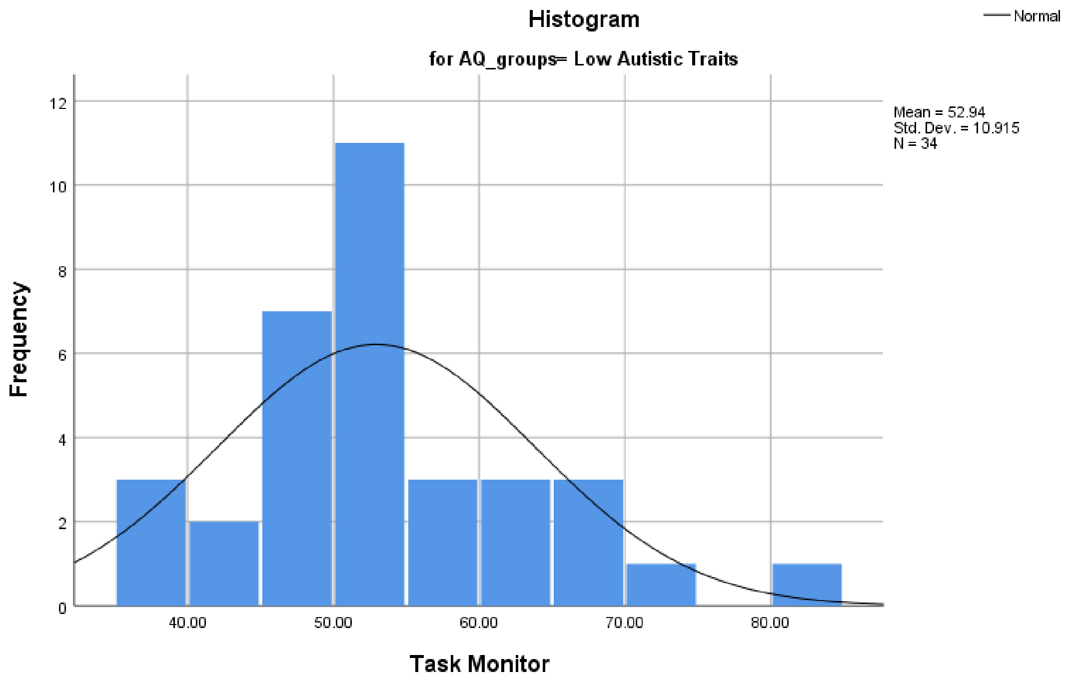
2
4
6
8
40.00
50.00
60.00
70.00
80.00
90.00
Plan/Organise


Histogram
for AQ_groups= Low Autistic Traits
Normal
Mean = 52.94
Std. Dev. = 10.915
N = 34
Frequency
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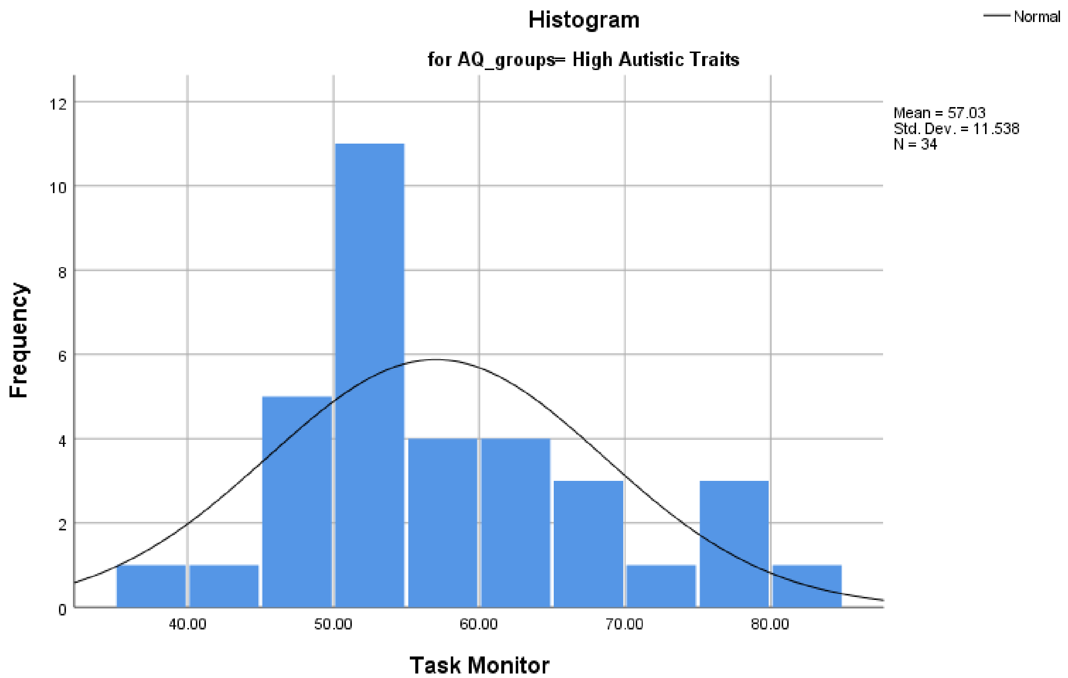
2
4
6
8
10
12
40.00
50.00
60.00
70.00
80.00
Task Monitor


Histogram
for AQ_groups= High Autistic Traits
Normal
Mean = 57.03
Std. Dev. = 11.538
N = 34
Frequency
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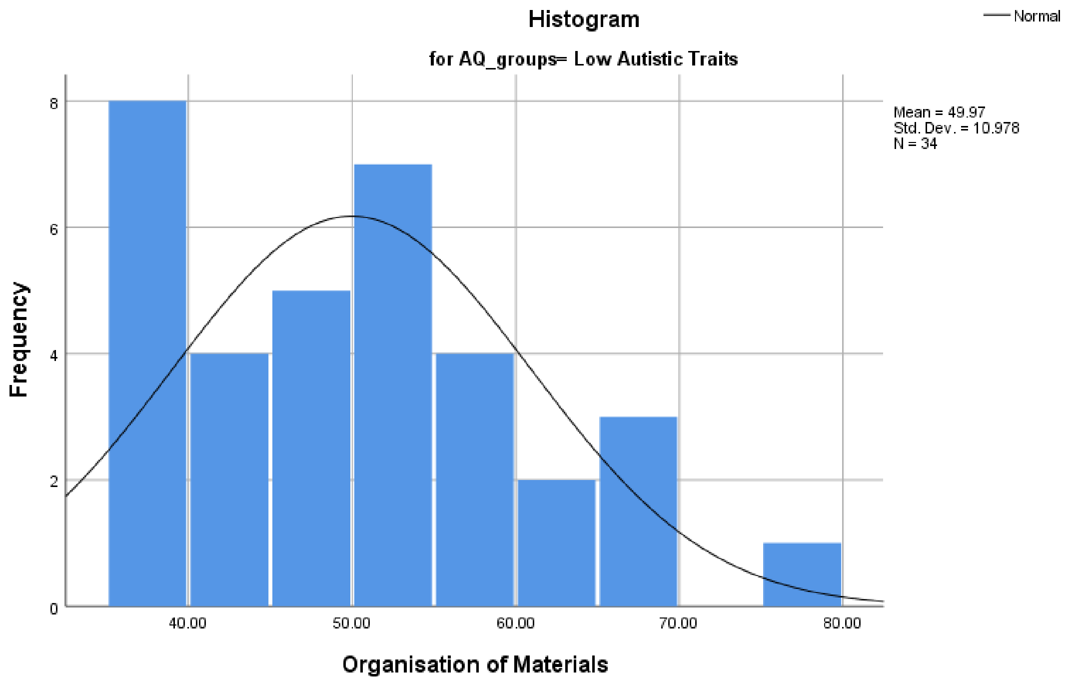
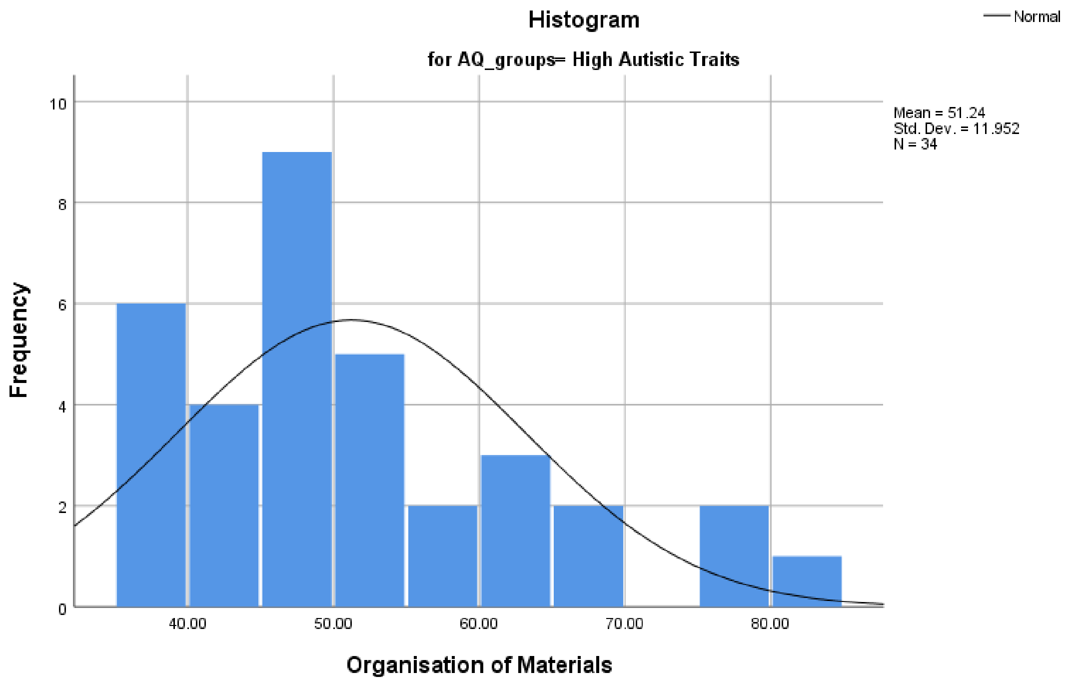
2
4
6
8
10
12
40.00
50.00
60.00
70.00
80.00
Task Monitor


Histogram
for AQ_groups= Low Autistic Traits
Normal
Mean = 49.97
Std. Dev. = 10.978
N = 34
Frequency
Organisation of Materials
0
2
4
6
8
40.00
50.00
60.00
70.00
80.00


Histogram
for AQ_groups= High Autistic Traits
Normal
Mean = 51.24
Std. Dev. = 11.952
N = 34
Frequency
Organisation of Materials
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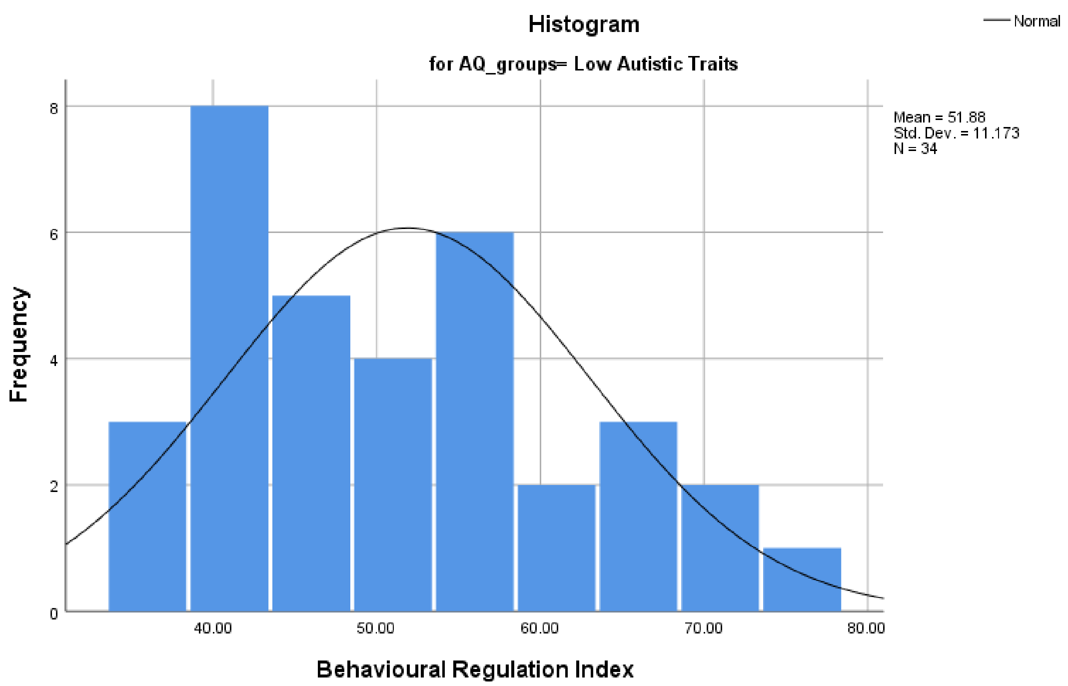
2
4
6
8
10
40.00
50.00
60.00
70.00
80.00


Histogram
for AQ_groups= Low Autistic Traits
Normal
Mean = 51.88
Std. Dev. = 11.173
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Frequency
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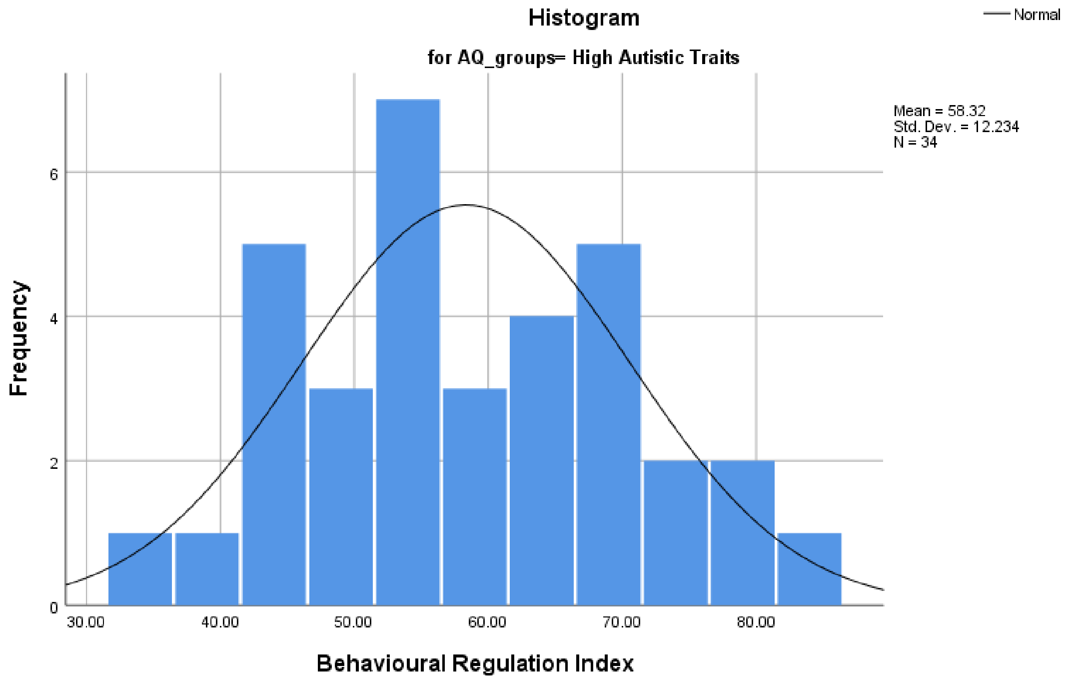
2
4
6
8
40.00
50.00
60.00
70.00
80.00
Behavioural Regulation Index


Histogram
for AQ_groups= High Autistic Traits
Normal
Mean = 58.32
Std. Dev. = 12.234
N = 34
Frequency
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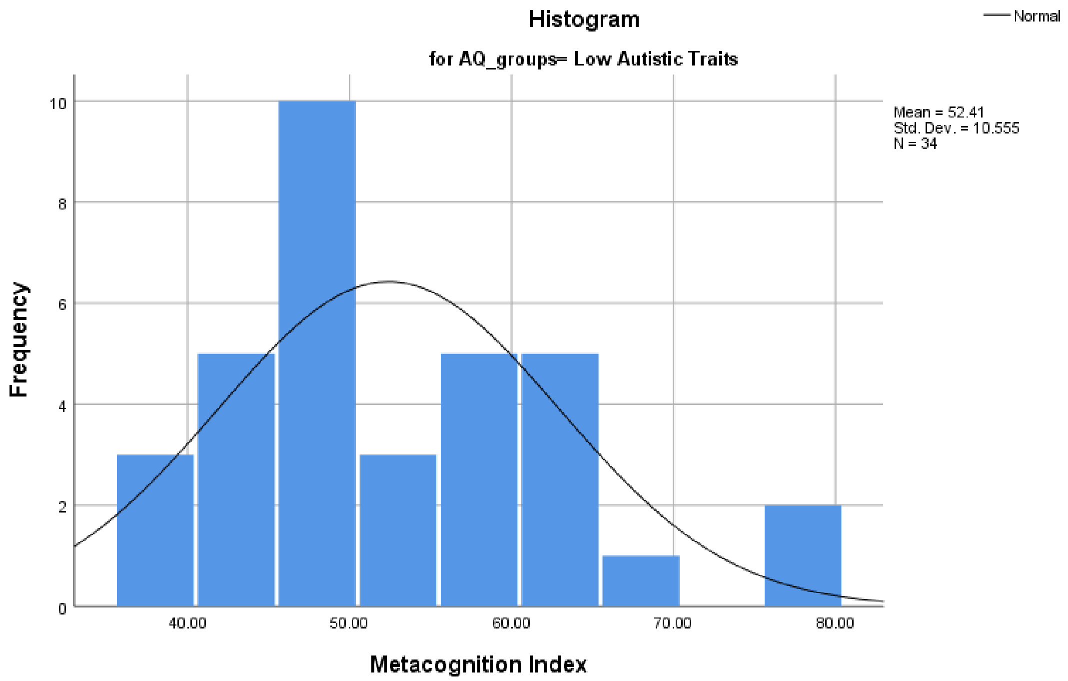
2
4
6
30.00
40.00
50.00
60.00
70.00
80.00
Behavioural Regulation Index


Histogram
for AQ_groups= Low Autistic Traits
Normal
Mean = 52.41
Std. Dev. = 10.555
N = 34
Frequency
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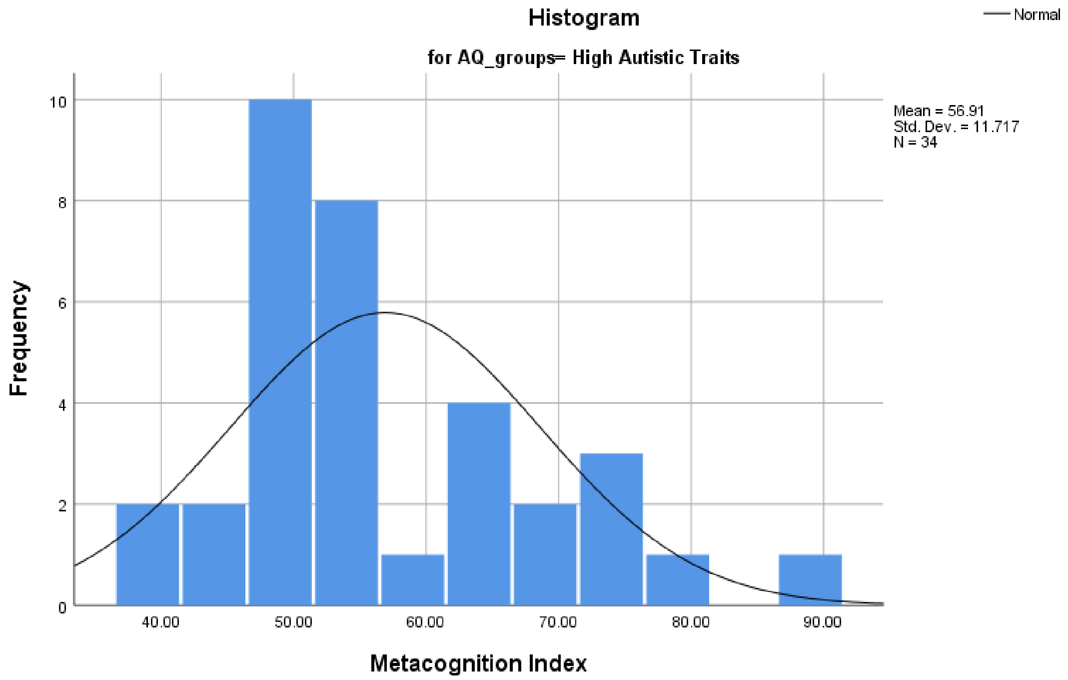
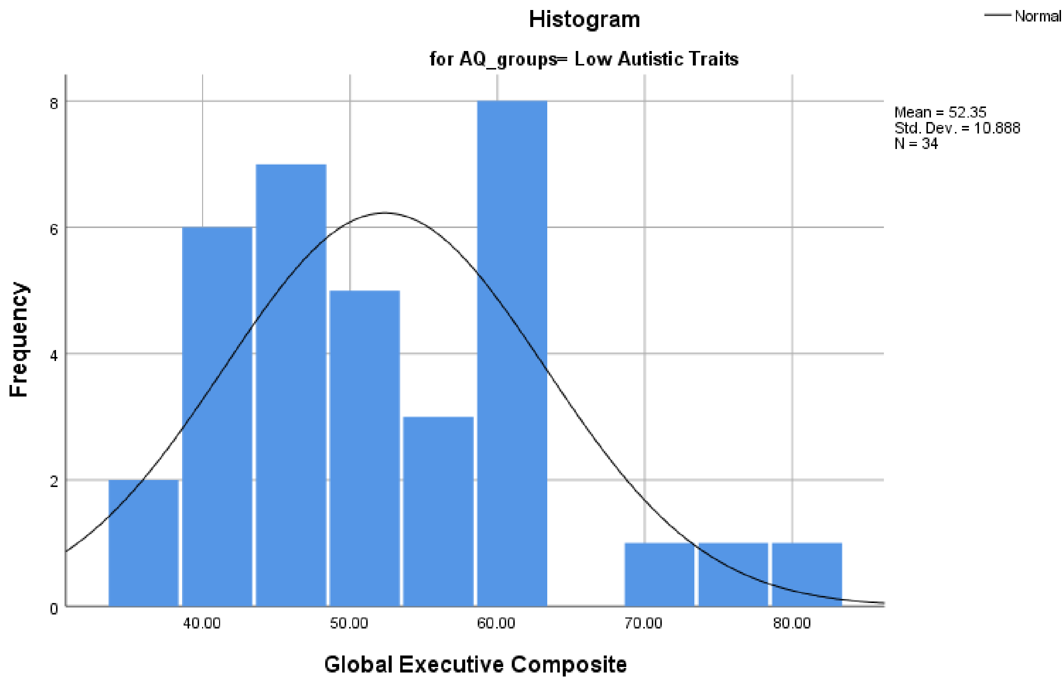
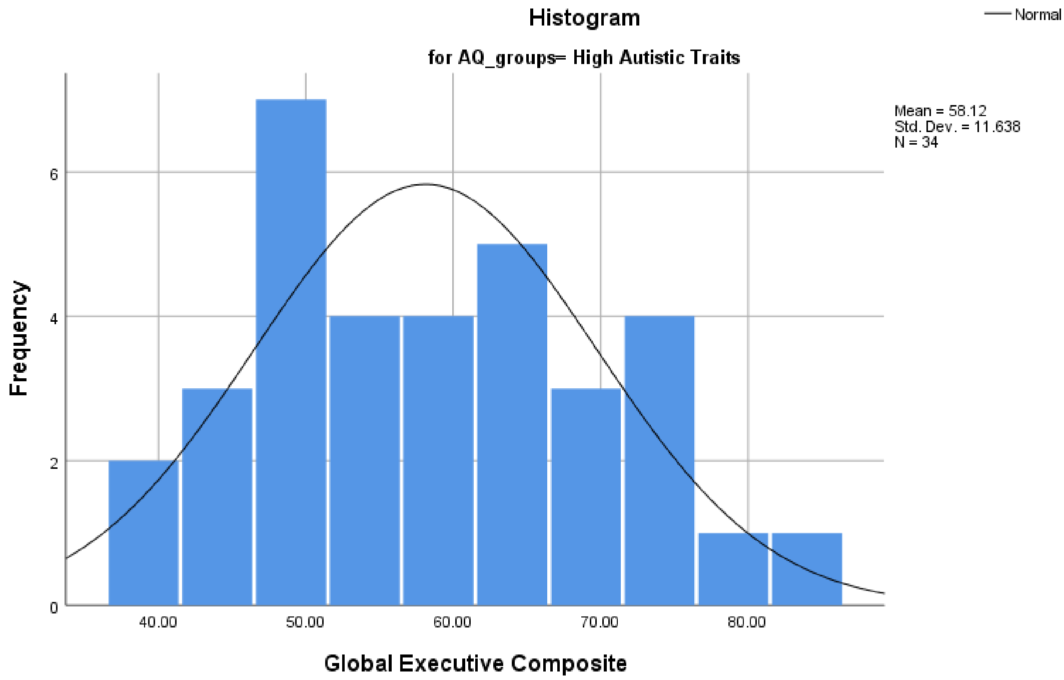
8
6
4
2
0
40.00
50.00
60.00
70.00
80.00
Metacognition Index


Histogram
for AQ_groups= High Autistic Traits
Normal
Mean = 56.91
Std. Dev. = 11.717
N = 34
Frequency
10
8
6
4
2
0
40.00
50.00
60.00
70.00
80.00
90.00
Metacognition Index




## Group Statistics

| | Autistic Traits Group | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| Inhibit | Low Autistic Traits | 35 | 51.943 | 10.7702 | 1.8205 |
| | High Autistic Traits | 34 | 56.324 | 14.5117 | 2.4887 |
| Shift | Low Autistic Traits | 35 | 50.0857 | 11.70815 | 1.97904 |
| | High Autistic Traits | 34 | 58.4412 | 12.14606 | 2.08303 |
| Emotional Control | Low Autistic Traits | 34 | 54.2941 | 11.32851 | 1.94282 |

| | | | | | |
|---|---|---|---|---|---|
| | High Autistic Traits | 34 | 57.2059 | 13.38199 | 2.29499 |
| Self-Monitor | Low Autistic Traits | 35 | 47.4286 | 11.06209 | 1.86983 |
| | High Autistic Traits | 34 | 54.3529 | 12.18266 | 2.08931 |
| Initiate | Low Autistic Traits | 35 | 52.6571 | 9.90230 | 1.67379 |
| | High Autistic Traits | 34 | 55.8824 | 12.61496 | 2.16345 |
| Working Memory | Low Autistic Traits | 35 | 54.9143 | 11.80322 | 1.99511 |
| | High Autistic Traits | 34 | 60.1176 | 12.05986 | 2.06825 |
| Plan/Organise | Low Autistic Traits | 35 | 50.5143 | 10.14997 | 1.71566 |
| | High Autistic Traits | 34 | 55.9706 | 11.17759 | 1.91694 |
| Task Monitor | Low Autistic Traits | 35 | 53.2286 | 10.88735 | 1.84030 |
| | High Autistic Traits | 34 | 57.0294 | 11.53778 | 1.97871 |
| Organisation of Materials | Low Autistic Traits | 35 | 50.2857 | 10.97476 | 1.85507 |
| | High Autistic Traits | 34 | 51.2353 | 11.95207 | 2.04976 |
| Behavioural Regulation Index | Low Autistic Traits | 35 | 51.7143 | 11.05221 | 1.86816 |
| | High Autistic Traits | 34 | 58.3235 | 12.23438 | 2.09818 |
| Metacognition Index | Low Autistic Traits | 35 | 52.6571 | 10.49914 | 1.77468 |
| | High Autistic Traits | 34 | 56.9118 | 11.71730 | 2.00950 |
| Global Executive Composite | Low Autistic Traits | 35 | 52.4286 | 10.73555 | 1.81464 |
| | High Autistic Traits | 34 | 58.1176 | 11.63788 | 1.99588 |

**Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 95% Confidence Interval of the Difference | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
| Inhibit | Equal variances assumed | .441 | .509 | -1.427 | 67 | .158 | -4.3807 | 3.0704 | -10.5092 | 1.7479 |
| | Equal variances not assumed | | | -1.421 | 60.853 | .161 | -4.3807 | 3.0835 | -10.5468 | 1.7855 |
| Shift | Equal variances assumed | .542 | .464 | -2.910 | 67 | .005 | -8.35546 | 2.87171 | -14.08741 | -2.62351 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Equal variances not assumed | | | -2.908 | 66.709 | .005 | -8.35546 | 2.87326 | -14.09097 | -2.61995 |
| Emotional Control | Equal variances assumed | 1.216 | .274 | -.968 | 66 | .336 | -2.91176 | 3.00692 | -8.91527 | 3.09174 |
| | Equal variances not assumed | | | -.968 | 64.249 | .336 | -2.91176 | 3.00692 | -8.91832 | 3.09479 |
| Self-Monitor | Equal variances assumed | .561 | .456 | -2.473 | 67 | .016 | -6.92437 | 2.79987 | -12.51293 | -1.33581 |
| | Equal variances not assumed | | | -2.470 | 65.962 | .016 | -6.92437 | 2.80383 | -12.52247 | -1.32627 |
| Initiate | Equal variances assumed | 2.333 | .131 | -1.183 | 67 | .241 | -3.22521 | 2.72580 | -8.66593 | 2.21551 |
| | Equal variances not assumed | | | -1.179 | 62.570 | .243 | -3.22521 | 2.73534 | -8.69209 | 2.24167 |
| Working Memory | Equal variances assumed | .277 | .600 | -1.811 | 67 | .075 | -5.20336 | 2.87278 | -10.93746 | .53074 |
| | Equal variances not assumed | | | -1.811 | 66.827 | .075 | -5.20336 | 2.87369 | -10.93955 | .53283 |
| Plan/Organise | Equal variances assumed | .215 | .644 | -2.124 | 67 | .037 | -5.45630 | 2.56894 | -10.58393 | -.32868 |
| | Equal variances not assumed | | | -2.121 | 65.962 | .038 | -5.45630 | 2.57258 | -10.59267 | -.31994 |
| Task Monitor | Equal variances assumed | .387 | .536 | -1.408 | 67 | .164 | -3.80084 | 2.69992 | -9.18990 | 1.58822 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Equal variances not assumed | | | -1.407 | 66.493 | .164 | -3.80084 | 2.70222 | -9.19525 | 1.59357 |
| Organisation of Materials | Equal variances assumed | .167 | .684 | -.344 | 67 | .732 | -.94958 | 2.76111 | -6.46077 | 4.56161 |
| | Equal variances not assumed | | | -.343 | 66.134 | .732 | -.94958 | 2.76457 | -6.46901 | 4.56985 |
| Behavioural Regulation Index | Equal variances assumed | .337 | .564 | -2.356 | 67 | .021 | -6.60924 | 2.80516 | -12.20836 | -1.01012 |
| | Equal variances not assumed | | | -2.353 | 65.877 | .022 | -6.60924 | 2.80934 | -12.21847 | -1.00002 |
| Metacognition Index | Equal variances assumed | .230 | .633 | -1.590 | 67 | .117 | -4.25462 | 2.67666 | -9.59725 | 1.08801 |
| | Equal variances not assumed | | | -1.587 | 65.738 | .117 | -4.25462 | 2.68096 | -9.60774 | 1.09850 |
| Global Executive Composite | Equal variances assumed | .772 | .383 | -2.112 | 67 | .038 | -5.68908 | 2.69430 | -11.06692 | -.31124 |
| | Equal variances not assumed | | | -2.109 | 66.201 | .039 | -5.68908 | 2.69749 | -11.07448 | -.30367 |